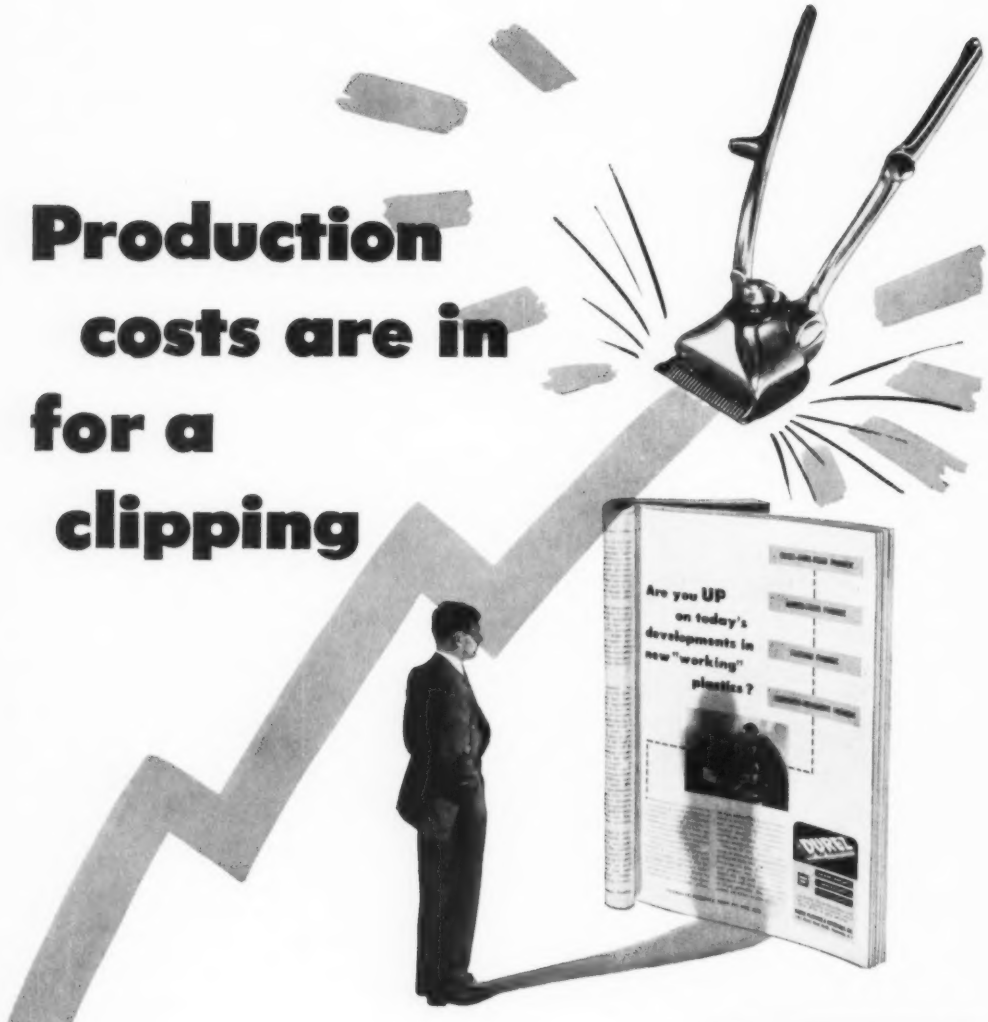
MODERN PLASTICS

FEBRUARY 1953

Production costs are in for a clipping



No longer a goal of the future but available now is a moldable, non-rusting material you can electroplate with gleaming metal surfaces...a *platable* phenolic plastic.

What would your design engineers think of another material, glass fiber filled yet readily moldable, with unheard of impact strengths ranging up to 20 foot-pounds per inch (Izod)?

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Durez phenolics specialists will gladly confer with you and your custom molder.

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DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Write, on office letterhead.

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Strong Market Performance of *Catalin Styrene* Pleases "Penny Bank Directors"

Gathered together under arched CATALIN STYRENE-molded "Snowflakes" (Interlocking Building Blocks), these selected *Penny Bankers,* also molded of CATALIN STYRENE, *endorse their own stock.* Are in unanimous agreement that its lightness of weight, color brightness, low cost, ease of processing and adaptability to hand-painting, have helped to win them a *top market* with the public.

"Father Rabbit", *Chairman of the Board*, stands 11⅝" high. He and his staff—"Jumbo Pig, Junior Pig, Chick and Barrel"—are provided with coin slots and base locks (some have keys). All, hold and safeguard "fortunes"!

Snowflakes interlock in 1001 varied ways, form into animals, trees, arches, toys, etc., and because they are precision molded of gayly assorted CATALIN STYRENE colors, they, too, have successfully "gone to market"!

It seems that all who mold with CATALIN STYRENE, are finding that *this stock pays off* in sales dividends!

Items shown, molded by Knickerbocker Plastic Co., Glendale, Cal.

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CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

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B. F. Goodrich Chemical Company does not make this vinyl sponge mop. We supply the Geon resin only.

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This mop is an example of a good sales idea—another hit for Geon polyvinyl materials, famous for bringing a new sales lift into so many products. Durable flooring, handsome draperies, rot-and-mildew-proof sails, delicate fish lures, even a rigid material that can be sawed, welded, machined or drilled—are typical Geon-helped successes.

Geon paste resin is just one of the Geon family of materials that includes other special-purpose resins, plastic granules and liquid latex. They can be used for coating, molding, casting or dipping. And they can make products resistant to heat and cold, water, abrasion, oils, greases and most chemicals.

Perhaps Geon is the answer to your sales problem—a means of helping you develop or improve more saleable products. For technical information, just write Dept. GB-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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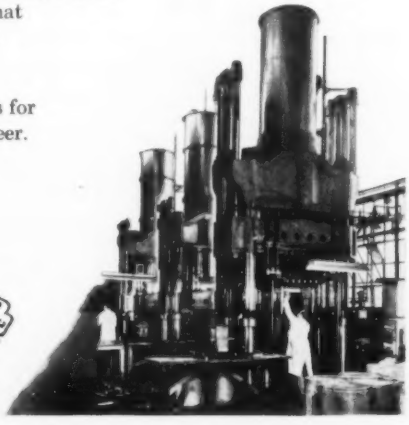
And, of course, along with this, Chicago Molded customers have the benefit of our more than 32 years experience . . . seasoned judgment that avoids misapplications . . . and the ability to get each job into production without delay.

So . . . if you have a part or a product in preparation that calls for molded plastics, talk things over with a Chicago Molded engineer. There's no obligation. Just write, wire or phone.



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Circulation Department
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Executive and Editorial Offices
575 Madison Ave., New York 22, N. Y.
Tel., PLaza 9-2710

Branch Offices
Chicago 11: 101 E. Ontario St.
J. M. Connors Tel., Delaware 7-0060
Cleveland 14: 815 Superior Ave.
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EDITORIAL

To Train Young Management

Industry, commerce, and government are all concerned today with one major problem: What happens to business when defense spending tapers off? Opinion surveys, market studies, logarithmic projections are being produced to determine what may be done to prevent a recession at that time and to establish an era of golden "normalcy."

The plastics industry, while not heavily involved in defense production, volume-wise, is bound to be affected by increased consumer availability of other materials now going largely into defense. The plastics industry will also be affected by the general level of employment, disposable consumer income, and the condition of economic health of the industries which are end users of plastics components. But the plastics industry will be most affected by the caliber and training of its own executive, sales, and production management.

The fact that individual companies in the industry have grown as rapidly and soundly as they have is itself a tribute to their management. The type of management, however, that is successful in building a new industry based on new materials and new techniques in a period of rapid economic expansion is not necessarily the type of management that will enjoy continued success in any era of "normalcy," no matter how golden, because the pioneer is not apt to be conditioned to the nuances and the delicate balances involved in squeezing profits and expansion and development funds out of the minutia of inventory control, market analysis, time-motion study, statistical quality control, assembly line layout, and similar management functions.

In a nutshell, we believe that a great many executives in the plastics industry—probably because of its newness, a higher percentage than in any other industry—are going to need executive education in many phases of management now fairly foreign to them if they are to make continued progress in whatever new economic era lies ahead.

Whether defense spending is to taper off in 1953 or 1954 is not the point. Whether the new Federal administration will favor harder or softer dollars, tighter or looser credit is not the point. The point is that all industrial management must be mentally and emotionally equipped to function with efficiency under new circumstances—even those of "normalcy."

How is this training to be acquired?

Surely among the material makers, among old-line industries, among the universities of business there exist both the talent and the established literature wherewith to provide executive training of a specialized nature for the young managements of the young and growing companies in the plastics industry. Surely the plastics industry as a whole can well afford to set up clinics for this purpose or to make other suitable arrangements.

Perhaps a university extension tie-up is the answer. Possibly district management clinics would be most effective. MODERN PLASTICS will welcome suggestions.

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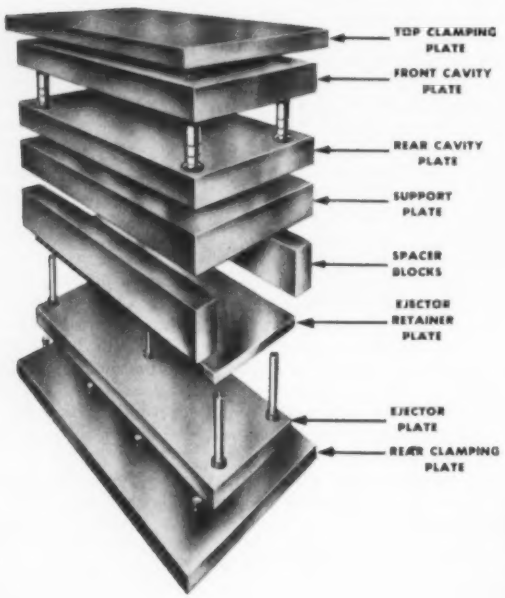

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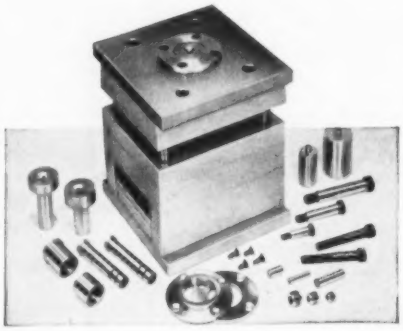
and Moldmakers' Supplies



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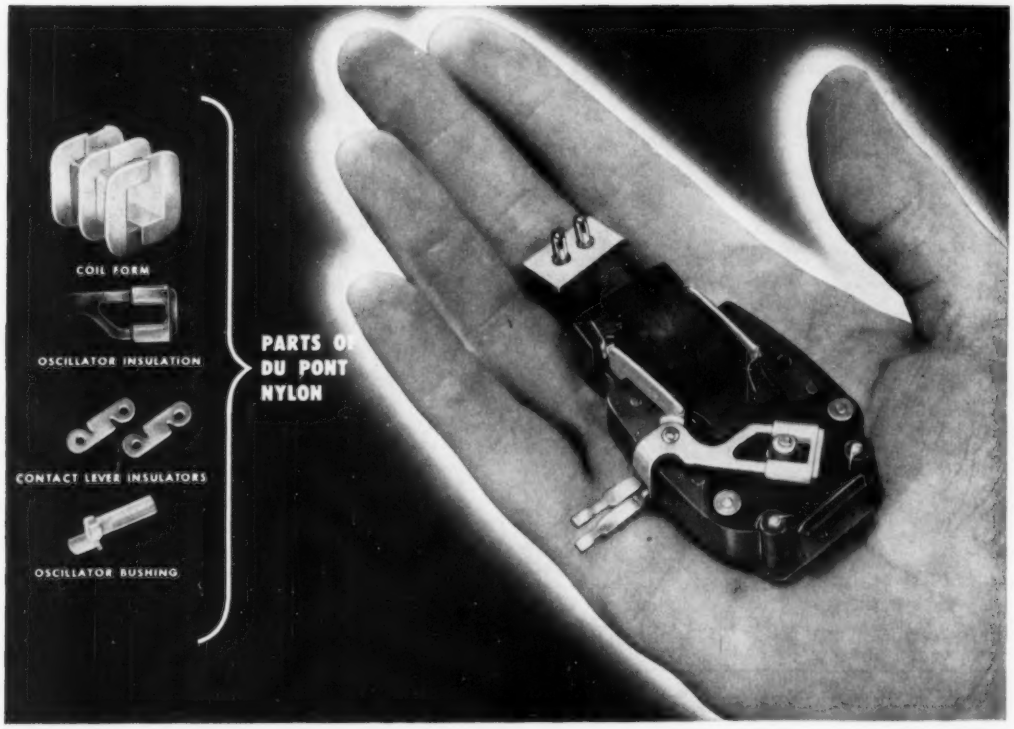

Parts molded of Du Pont nylon by and for Remington Rand, Inc., Bridgeport, Conn.

Parts of Du Pont NYLON cut wear and noise in electric shaver motor . . .

need no lubrication . . . trim production costs

The rotor of the Remington "60" Electric Shaver spins 8,500 times per minute to push 132 blades through 16,000,000 cutting strokes. To help provide long, efficient service of the shaver, four key parts had to be made of a material possessing outstanding mechanical, electrical and thermal properties. These parts are the coil form, oscillator bushing, oscillator insulation and contact lever insulator.

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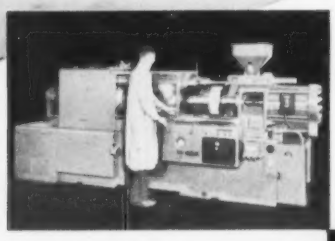

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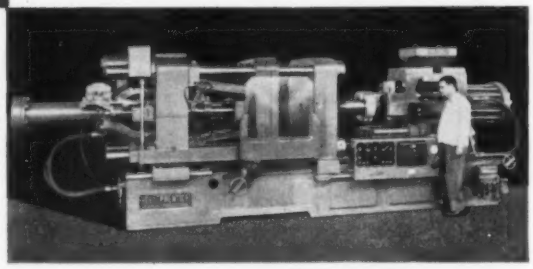
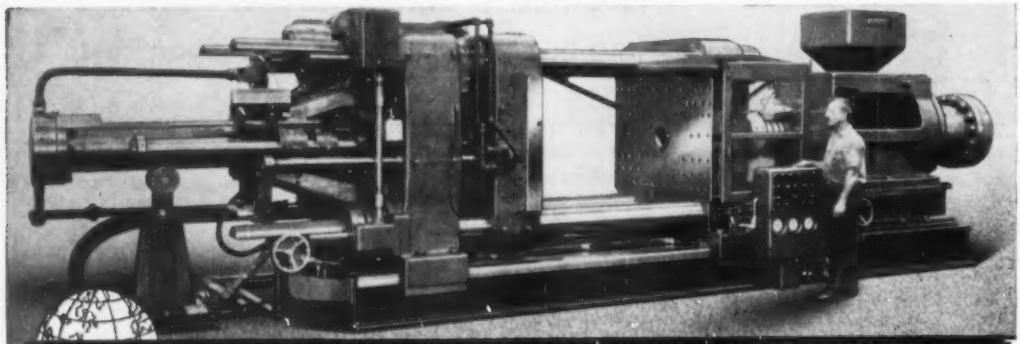


600T-32 OZ.

Specifications	4 oz.	8 oz.	12 oz.	16 oz.	20 oz.	32 oz.	200 oz.
Die locking pressure, tons	125	275	275	350	400	600	1500
Rated Casting area, sq. in.	50	125	125	150	200	300	700
Mold opens	8"	10¼"	10¼"	13"	16"	24"	36"
Max. die space	12"	16"	16"	30"	24"	32"	40"
Size of die plates	16x21"	21x25"	21x25"	36x38"	40x45"	45x54"	60x72"
Weight, lbs.	9700	12,850	16,250	30,000	32,000	46,100	92,000

1500T-200 OZ.



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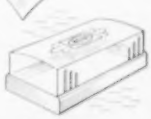

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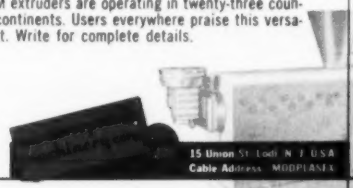

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as preferidas em todos os países do mundo

Em todos os países do mundo onde se fabricam produtos de matérias plásticas se acham as máquinas de recalque da Modern Plastic Machinery produzindo varetas, canos, tubos, chapas, filmes, esferas para moldes de injeção, fio coberto, filamentos contínuos, fôrmas e uma grande variedade de produtos de precisão fabricados pelo mesmo sistema.

A preferencia geral de que gosa o equipamento MPM é baseada em muitas qualidades de reconhecida superioridade:

- construção sólida resistente à corrosão de todas as peças que entram em contacto com resinas plásticas
- instalação simplificada — basta ligar à água e à electricidade
- funcionamento exento de dificuldades e manutenção mínima
- um sistema de controle de calor insuperavel, incluindo parafusos machos e arrefecimento por camisas radiais em 9 a 15 zonas
- transmissões amplas de velocidade variavel e indicador conjugado de velocidade do parafuso

As máquinas de recalque MPM funcionam atualmente em 23 países dos cinco continentes. Os donos de tais máquinas em toda parte não se cansam de elogiar o equipamento adatavel a tão grande e variado número de aplicações. Escreva-nos pedindo detalhes completos.

15 Union St. Lodi, N. J. USA
Cable Address: MODPLASEX

MACCHINE DI ESTRUSIONE mfm

preferite in tutto il mondo

Ovunque materiali plastici vengono fabbricati, si vedono macchine di estrusione della Modern Plastic Machinery Corporation che producono bacchette, canne, tubi, lastre, pellicole, tavolette di stampaggio ad iniezione, fili rivestiti, filamenti continui, forme, e molti altri articoli di precisione fabbricati in base ad estrusione.

La preferenza di cui il macchinario MPM gode dappertutto si basa su diversi vantaggi ben provati, e cioè:

- costruzione solida e resistente alla corrosione di tutte le parti che vengono in contatto colla resina plastica
- semplicità d'installazione: basta connettere l'acqua e la corrente elettrica
- funzionamento esente da disturbi e costo di manutenzione minimo
- sistema insuperabile di regolazione di calore, incluse viti cave nonchè 9 a 15 zone di raffreddamento a camice radiali
- trasmissioni ampie, di velocità variabile, ed indicatore di velocità della vite, incorporato nell'apparecchio

Le macchine di estrusione MPM vengono usate attualmente in 23 paesi di tutte le parti del mondo. I rispettivi proprietari non si stancano di elogiarne la versatilità e facile applicazione a tutti i scopi pertinenti. Per ulteriori dettagli, favorite scriverci.

15 Union St. Lodi, N. J. USA
Cable Address: MODPLASEX

LES MACHINES A REFOULER mfm

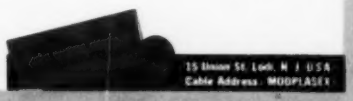
sont les préférées dans le monde entier

Dans toutes les parties du monde où les matières plastiques sont fabriquées, vous rencontrerez des machines à refouler de la Modern Plastic Machinery Corporation en train de faire des tringles, des tuyaux, des tubes, des tôles plates, des pellicules, des grenetés, des fils guipés, des filaments continus, profils de formes déterminées et une grande variété d'autres produits de précision refoulés.

La préférence universelle pour les appareils MPM est basée sur certaines supériorités justifiées:

- construction robuste résistant à la corrosion de tous les organes se trouvant en contact avec les résines plastiques
- installation simplifiée — reliez simplement l'eau et l'électricité
- fonctionnement sans ennuis et frais d'entretien minimes
- un système de contrôle de la chaleur sans pareil, comprenant les vis évidées et de 9 à 15 zones de refroidissement à chemise radiale
- nombre ample de commandes de vitesses variables et indicateur de vitesse encastré de la vis d'avance

En ce moment les machines à refouler MPM fonctionnent dans 23 pays dans cinq continents. Tous les usagers font des éloges de cet appareil aux talents variés. Demandez-nous des détails complets.



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Cable Address: MODPLASEX

KLEESTRON

the *VERSATILE* plastic

NO need to state the virtues of polystyrene.
It is accepted all over the world for its versatility . . .
its adaptability. At long last the designer has been given
a moulding powder reasonably free from limitations.
No need either to state the virtues of Kleestron.
Enough to say it is made by Kleemann's
in their new factory at Welwyn Garden City
and is being sold . . . and moulded . . .
and praised all over the world.

Address all enquiries to the sole manufacturers:—

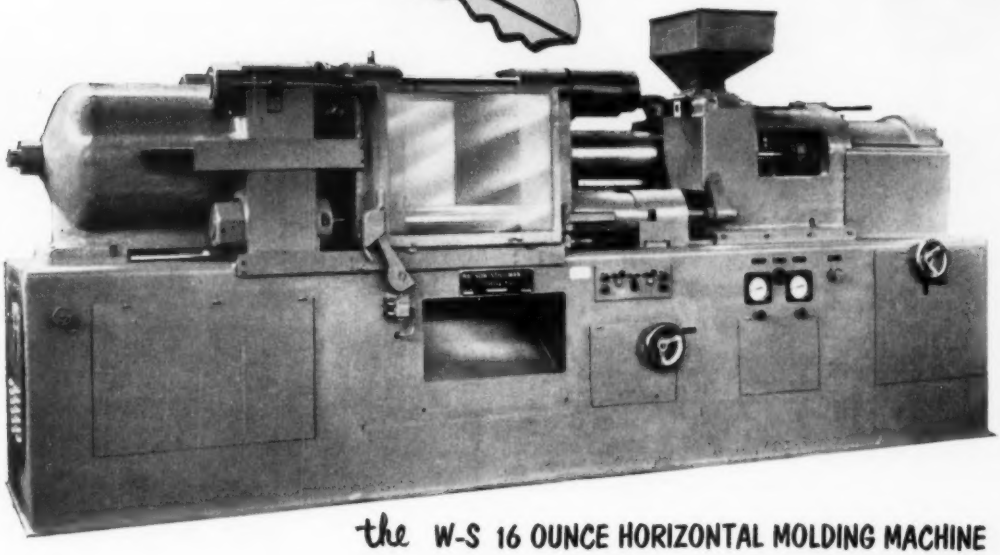
O. & M. KLEEMANN LTD.

WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON · S.W.1 · ENGLAND

Cables — KLEEMARRO · LONDON

the SURE KEY to higher plastics production

Three-zone temperature control



the W-S 16 OUNCE HORIZONTAL MOLDING MACHINE

Experience has shown that the day-to-day shirt-sleeve jobs are done most economically on the intermediate size machines—notably the famous W-S 16 ounce Injection Molder.

There's more than size, however, behind the outstanding preference for this model. Consider, for example, a single machine in which *all* these features are offered:

- Extra long heating cylinder for increased plasticizing efficiency . . . COMPARE!
- Three-zone temperature control . . . COMPARE!
- Replaceable bronze bushings in cylinder and moving platens...COMPARE!
- Faster cycles with dual pressure controls . . . COMPARE!
- Hydraulic and electric safety controls . . . COMPARE!
- Special pumping unit . . . COMPARE!
- Remote control panel . . . COMPARE!

If *your* profits are coming in something less than the full measure, it will pay you handsomely to investigate this profit-booster NOW. Detailed literature and/or personal analysis without obligation.

W-S HYDRAULIC

THE WATSON-STILLMAN COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

150 Aldene Rd., Roselle, New Jersey

Foreign Sales Representatives: OMNI PRODUCTS CORP, 460 Fourth Avenue, New York 16, N. Y.

Correspondents Throughout the World

NO. ½ T. D.
MATERIAL GRANULATOR

CAPACITY: 500 lbs. an hour based on Polystyrene scrap with 5/16" screen.

HORSEPOWER: 7½

THROAT OPENING:
Regular—5⅛" x 20"
Model 451—8" x 20"

FLOOR SPACE: 3'8" x 3'11"

WEIGHT: 1100 lbs.

SPECIAL DESIGN ADVANTAGES

Small floor space required but high capacity

Available with large throat for material that is difficult to feed

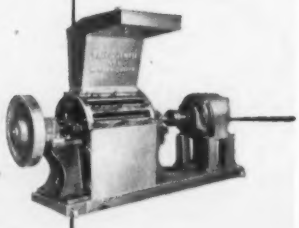
Convenient material collecting bin

Easily accessible for cleaning

Your grinder source for every individual plastic material cutting requirement and capacity (50 to 3,000 lbs. per hr.)—Ball & Jewell, machine tool builders since 1865, have always paced the grinding needs of the plastics industry. Send us your requirement specifications.

Require A Smaller Machine?
B & J STANDARD IDEAL
Throat opening: 3½" x 10" or 6" x 10"
Horsepower: 2
Capacity: 250 lbs. an hour

Require A Larger Machine?
B & J No. 1 CUTTER
Throat opening: 7" x 24"
Horsepower: 10
Capacity: 750 lbs. an hour



BALL & JEWELL, INC. *Leadership Through Continuous Engineering Improvements*

22 FRANKLIN STREET, BROOKLYN 22, NEW YORK

What's YOUR Line?

ELECTRIC ELECTRONIC ?

RADIO TELEVISION MUSIC ?

APPLIANCES HOUSEWARES ?

SOMETHING ELSE ?

These applications demonstrate *our* line—custom moulding of thermosetting plastics. Complete moulding facilities, including design and mould-making!

Note, please, that some of these parts are quite intricate. Note, too, that while the majority of these pieces are moulded of standard thermosetting materials, quite a few are made of newer materials with which we've acquired a working knowledge almost unique in the industry. Pieces numbered 19, 20, 23, and 24 are moulded of Teflon—those numbered 2, 21 and 22, of glass-reinforced plastics—numbers 6 and 12, of Alkyd.

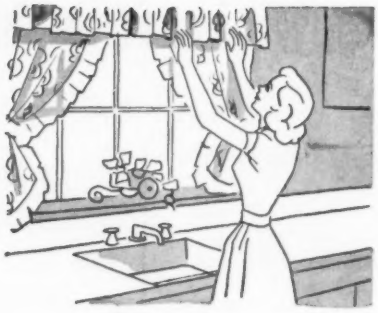
Based on experience like this, don't you think *your* line could benefit from service by *our* line? Phone or write our Dayton office—or your local branch office—for full information.

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, Lexington 2-6677 • Rochester, Hillside 4352 • Chicago, Merrimac 7-1830 • Detroit, Trinity 3-7050 • Philadelphia, Hilltop 6-6472 • Dallas, Logan 6-5234 • Los Angeles, Richmond 7-5381 • St. Louis, Delmar 9577 • Toronto, Riverdale 3511
EXPORT OFFICE: 89 Broad Street, New York City, Bowling Green 9-7751.

Kurz-Kasch
FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS

1. For high translucence. "Dutch Boy" Plumb-O-Sil C has a refractive index that closely coincides with that of vinyl chloride resin. That's why Plumb-O-Sil C assures highly translucent stocks for a wide variety of products.



2. For better color. "Dutch Boy" Plumb-O-Sil C stabilizer has no appreciable tinting strength. You get good stability in deep shades and vivid colors because Plumb-O-Sil C performs well with almost all dyes and pigment additions.

Stabilize your translucent vinyl stock with "Dutch Boy" PLUMB-O-SIL C

3. For easier dispersion. "Dutch Boy" Plumb-O-Sil C needs *no* pre-dispersion. You get heat stability with less work and trouble in processing.

If you have a special problem in stabilizing your translucent vinyl compounds, consult our technical staff. They will be glad to help you. Or write for additional information and technical data on "Dutch Boy" Plumb-O-Sil C.

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols. Exceptional weathering characteristics
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

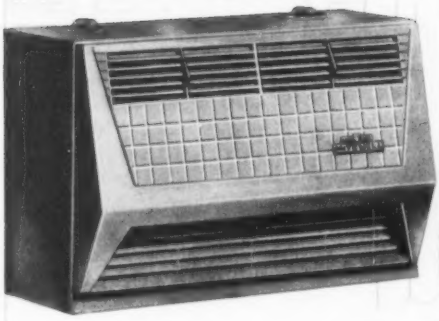
Dutch Boy* CHEMICALS

*Reg. U. S. Pat. Off.

NATIONAL LEAD COMPANY

111 Broadway, New York 6, N. Y.

New MITCHELL ROOM AIR CONDITIONER



Molded by Amos MOLDED PLASTICS

Another job done right by AMOS . . .

The new MITCHELL Room Air Conditioner . . . a streamlined beauty in high-impact Styrene with eye-appealing "decorator's beige" finish . . . sets new standards in *cool comfort* for modern homes and offices.

Lighter weight, less assembly, rustproof . . .

The entire front is molded in one piece . . . with two *reversible* grille inserts for changing air deflection . . . compact efficiency for increased customer satisfaction.

How AMOS can help you . . .

You benefit from AMOS' wide experience in producing *new* applications . . . with the industry's *most modern* injection molding equipment . . . 4 to 300 ounce machine capacity.

Complete AMOS responsibility . . .

You benefit from AMOS' ability to handle your *complete* job . . . designing . . . engineering . . . mold building . . . molding . . . painting . . . printing . . . hot stamping . . . metalizing on plastics . . . complete conveyorized assembly.

No obligation—write, wire or phone today:

AMOS MOLDED PLASTICS, EDINBURG, INDIANA • Offices: New York, Chicago, Detroit, Philadelphia, Nashua, N. H.

LET AMOS' SKILLS WORK FOR YOU

More new developments in AMERICAN ANODE *materials*

Two handy ideas for new sales!

Controlled viscosity gel and plastisol simplify production!

PICTURED here are two new American Anode materials which can open up new sales fields for you. On the left you see Ameran CV-G (controlled viscosity gel). Putty-like in form, it can be hand-molded like modeling clay. No warm-up or heating is required. Articles are fused *after* removal from the mold —leaving the mold ready for immediate re-use. Ameran CV-G can be molded, cold dipped, cast, extruded or spread.

The picture on the right shows Ameran CV-P (controlled viscosity plastisol) being used for cold dipping household gloves. It may be used on vertical forms for dipping plastisol, without heat treatment of the form. Flow characteristics permit close control and uniformity of film thickness. And you get a uniform film with good elongation. Ameran CV-P may be used for cold dipping, coating, molding or casting.

The viscosity of both Ameran CV-G and Ameran CV-P is controlled—does not change in storage. Both compounds can be made resistant to oils, greases, most chemicals and acids. No solvents are needed, eliminating fire hazard. No recovery system. Wide range of colors possible, including white. You'll think of many sales-making uses for these versatile materials. For technical information, please write Department AD-1 American Anode, 60 Cherry Street, Akron, Ohio.

AMERICAN ANODE

A Division of The B. F. Goodrich Company

CRUDE AND AMERICAN RUBBER LATICES, WATER CEMENTS AND SUSPENSIONS,
AMERAN RESIN PASTES, COMPLETE MANUFACTURING FACILITIES

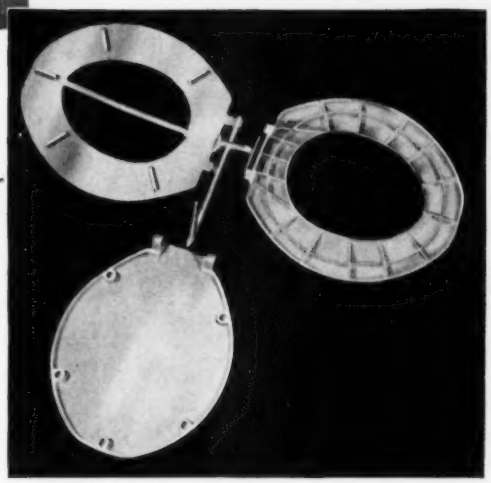
FOR

BIG JOBS

THE H-P-M

60 oz.

IS TOPS!

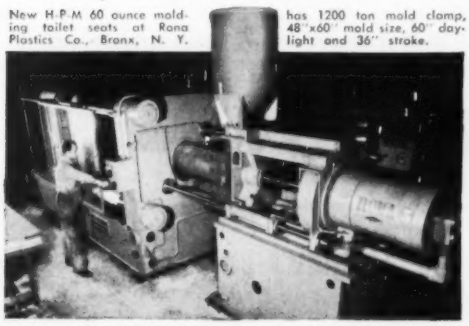


Here's a real test of a 60-ounce machine . . . over 500 square inches of projected area in this 3-piece, full-size acetate toilet seat.

For the most profitable seat production, you can't beat the economy of a one-machine—one-operator setup . . . and, it's a real production job—less than a two-minute overall cycle. In addition, you get a perfect color mottle match, which is very difficult in single cavity mold operations.

Regardless of what big parts you are thinking of molding . . . refrigerator and deep freeze components . . . parts for TV, large radio cabinets and other similar items . . . the H-P-M "60" is tops! Write today for details.

New H-P-M 60 ounce molding toilet seats at Rona Plastics Co., Bronx, N. Y. has 1200 ton mold clamp, 48"x60" mold size, 60" daylight and 36" stroke.

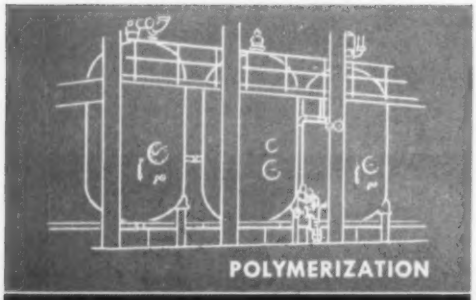


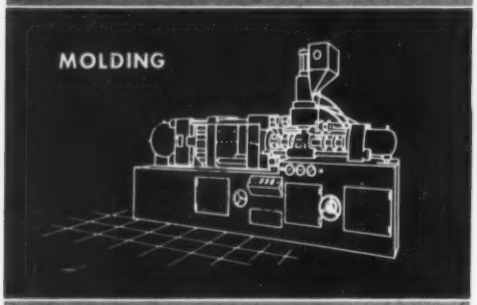
HPM

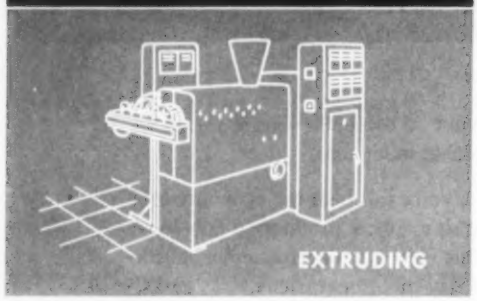
THE HYDRAULIC PRESS MFG. CO.

1019 Marion Road, Mount Gilead, Ohio, U. S. A.

Presses for Every Pressure Processing Application







THROUGHOUT the plastics industry, *reliable* controlling instruments are becoming more and more important every day.

For example—in the preparation of plastic molding powders, Honeywell control systems can be relied upon to more effectively keep processes at peak efficiency . . . maintain top production.

And, in molding or extruding, *Pyr-O-Vane* controllers are just as important in the control of temperatures . . . to produce more product, of higher quality, at lower cost.

Whatever your operation . . . polymerization, molding or extruding . . . the quality, price and sales appeal of your product rest heavily on the instruments you use.

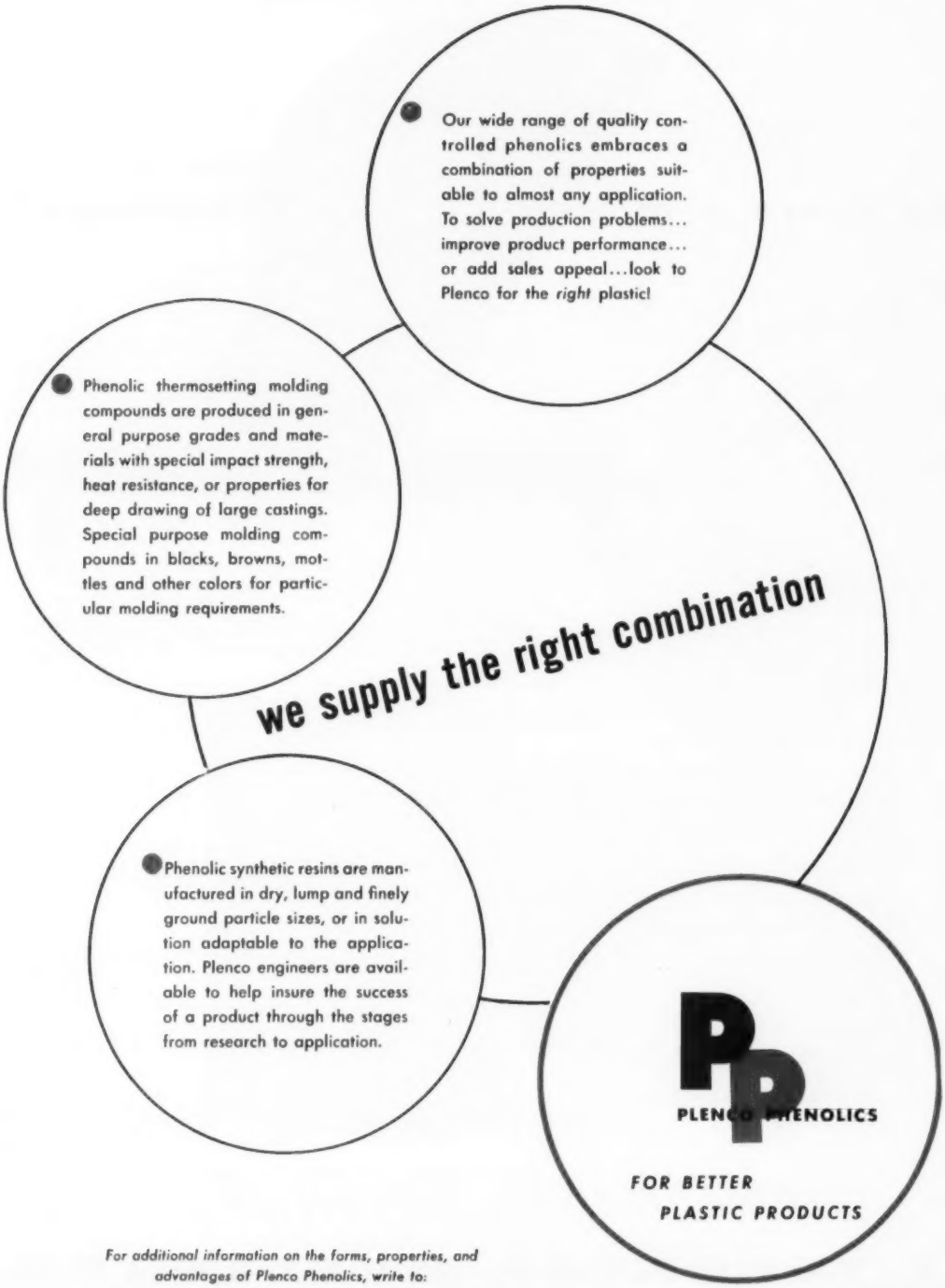
With so much at stake, you'll do well to count on Honeywell. Our local engineering representative is well qualified to recommend instrumentation best suited to your requirements. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4437 Wayne Ave., Philadelphia 44, Pa.

How important are instruments to you?

● *Reference Data:* Write for Composite Catalog No. 5000—a handy reference to the complete Honeywell line.

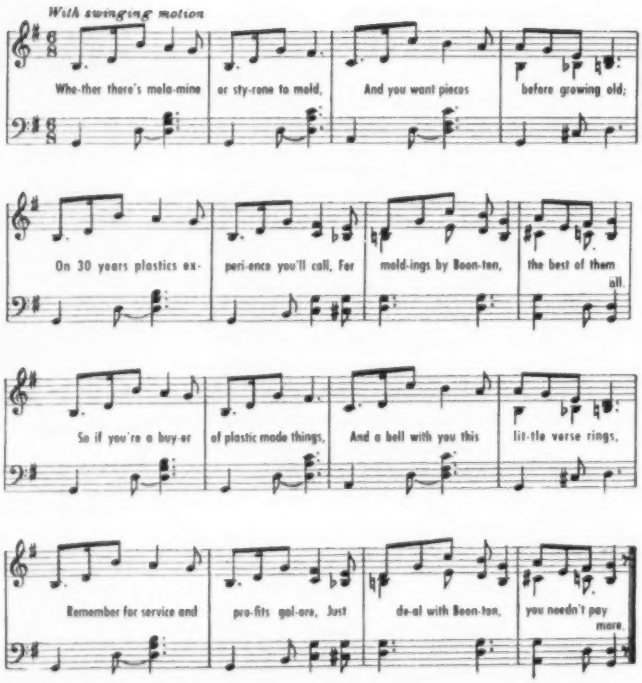
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls


Our wide range of quality controlled phenolics embraces a combination of properties suitable to almost any application. To solve production problems... improve product performance... or add sales appeal...look to Plenco for the *right* plastic!
Phenolic thermosetting molding compounds are produced in general purpose grades and materials with special impact strength, heat resistance, or properties for deep drawing of large castings. Special purpose molding compounds in blacks, browns, mottles and other colors for particular molding requirements.
we supply the right combination
Phenolic synthetic resins are manufactured in dry, lump and finely ground particle sizes, or in solution adaptable to the application. Plenco engineers are available to help insure the success of a product through the stages from research to application.
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

For additional information on the forms, properties, and advantages of Plenco Phenolics, write to:

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Is there a musician in the audience?

With swinging motion

Whe-ther there's mela-mine or sty-rene to mold, And you want pieces before growing old;
On 30 years plastics ex- peri-ence you'll call, For mold-ings by Boon-ton, the best of them all.
So if you're a buy-er of plastic made things, And a bell with you this lit-tle verse rings,
Remember for service and pro-fits gal-ore, Just de-al with Boon-ton, you needn't pay more.

Who is the world's only custom molder to offer you that marvel of modern-day marvels—a singing commercial? Why, Boonton, of course!

Take it home and try it on the family piano. We assume no responsibility for the results . . . But after you've finished crooning, if you need solace . . . or fine custom molding, we're the guys to see.

Now, start with an arpeggio . . .

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

YOU'LL NEVER HAVE TO SAY

"Pardon the Extrusion"

USE DAVIS-STANDARD EXTRUDERS

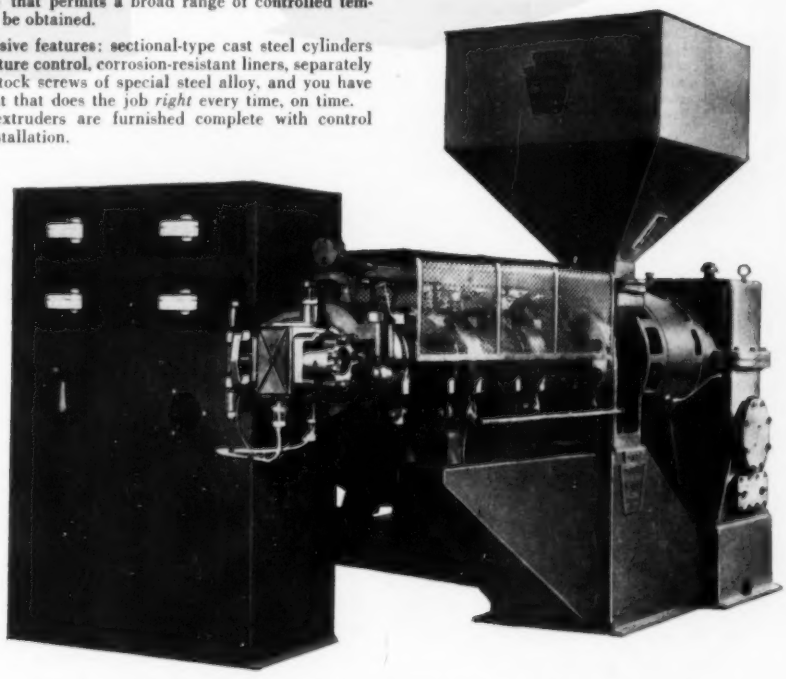
Production perfection is *engineered* into Davis-Standard thermoplastic extruders to meet *your* specific problem. They are the *only* plastics extruders with these features:

"Stream-Flo" insulating head that assures the most efficient operating velocities.

Therma-Fin* heating jacket (range-type tubular heating elements and stainless steel cooling coils cast into aluminum cooling fins) that permits a broad range of controlled temperatures to be obtained.

Add to these exclusive features: sectional-type cast steel cylinders for precise temperature control, corrosion-resistant liners, separately cast feed section, stock screws of special steel alloy, and you have extrusion equipment that does the job *right* every time, on time.

Davis-Standard extruders are furnished complete with control panel, ready for installation.



Let Your Engineers Work with Ours. We'll Meet *Your* Requirements.

*Patent Pending

THE STANDARD MACHINERY COMPANY

16 WATER STREET, MYSTIC, CONNECTICUT

MOLDING PRESSES AND EXTRUSION MACHINES

World's Largest Manufacturers of Custom-Built Extrusion Machines

Export Office: Ballagh & Thrall, Independence Square, Philadelphia 6, Pa.

Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Germany Patent 829,248 September 25th, 1949. Great Britain Patent 662,219 September 27th, 1949. Argentina Patent 96,970 September 30th, 1949. Brazil Patent 39,676 December 29th, 1951. Mexico Patent 51,615 January 3rd, 1952. Other U. S. and Foreign Patents Pending.

TUPPER / Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER!

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

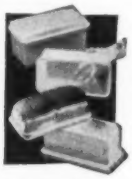
Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

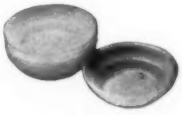
TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Por Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.



When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

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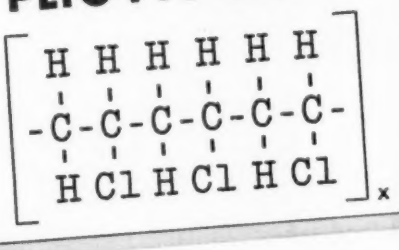
For rapid, low-temperature processing

Use this great NEW polyvinyl chloride resin PLIOVIC G80V



PRODUCTION TRIAL #156
Pliovic G80V: Goodyear Resin

The resin, stabilizer and lubricant were placed in the blender, the blades started rotating, hot plasticiser was poured in across the batch, and the lid of the blender lowered. The batch was completely blended for mill mixing in less than a minute and it flowed out through the opening at the top with no difficulty whatsoever. The batch was satisfactorily blended even after this very short cycle.

Two mills were used for banding the compound, and one mill was used to finish the fluxing and stripping off. It was all the two breakdown mills could do to keep up with the stripping mill, and the granulator could not keep up with production due to the fact that the resin fluxed and milled so rapidly. This is the fastest processing resin we have ever seen.

● Now available in commercial quantities, PLIOVIC G80V is the second in a series of new Goodyear polyvinyl chloride resins. Introduced primarily for use where low temperatures (20-40° F lower than PLIOVIC G90V) and rapid processing are required, its success has been proved by customer use across the country — with results like those shown in the production report.

You can secure samples and full details for evaluation in your own plant on both PLIOVIC G90V and the *new* G80V by writing:

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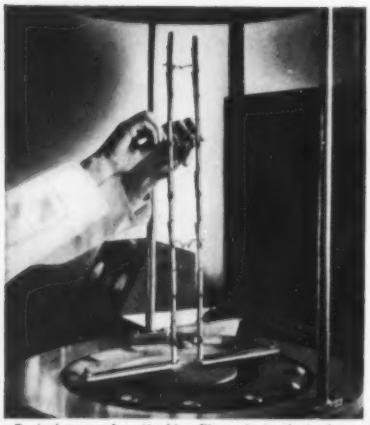
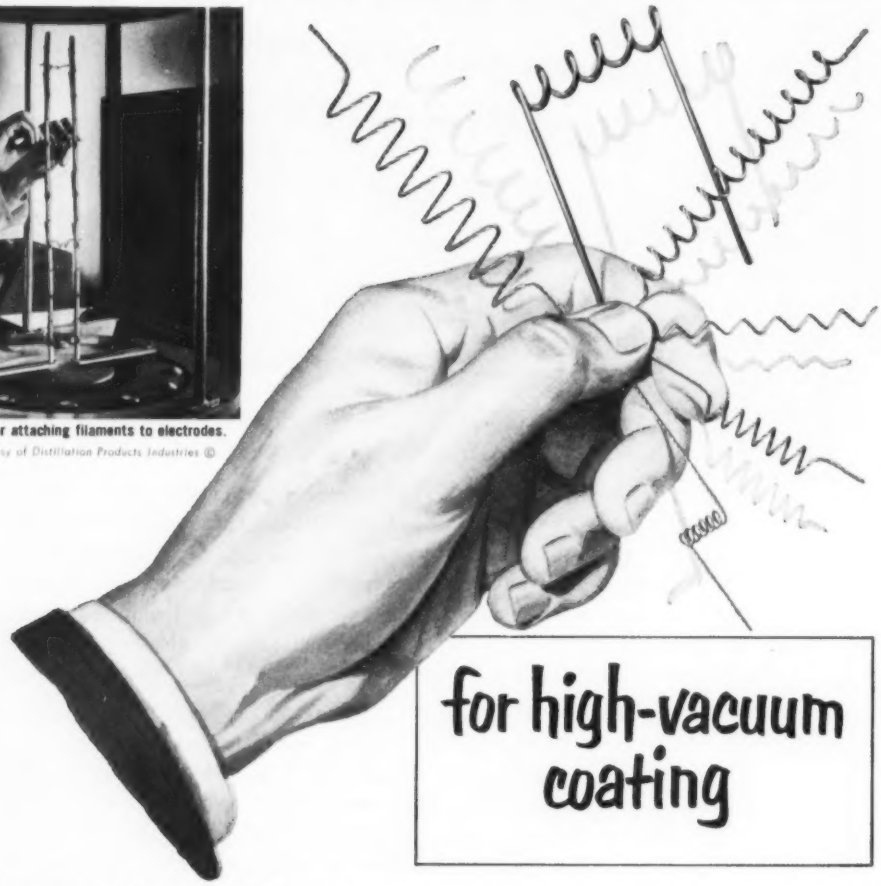
Sylvania Tungsten Coils



Typical means for attaching filaments to electrodes.

Photograph courtesy of Distillation Products Industries ©



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Sylvania custom made tungsten coils assure highest performance at lowest cost

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Here's why Sylvania Tungsten Coils save you money:

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Sylvania offers a complete line of efficient ready made coils. Each of these high grade tungsten filaments is designed for a specific job. Each has the most efficient section and surface area to assure you excellent performance . . . at the lowest cost.

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For full information write for the free Sylvania Brochure 3T-5002, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

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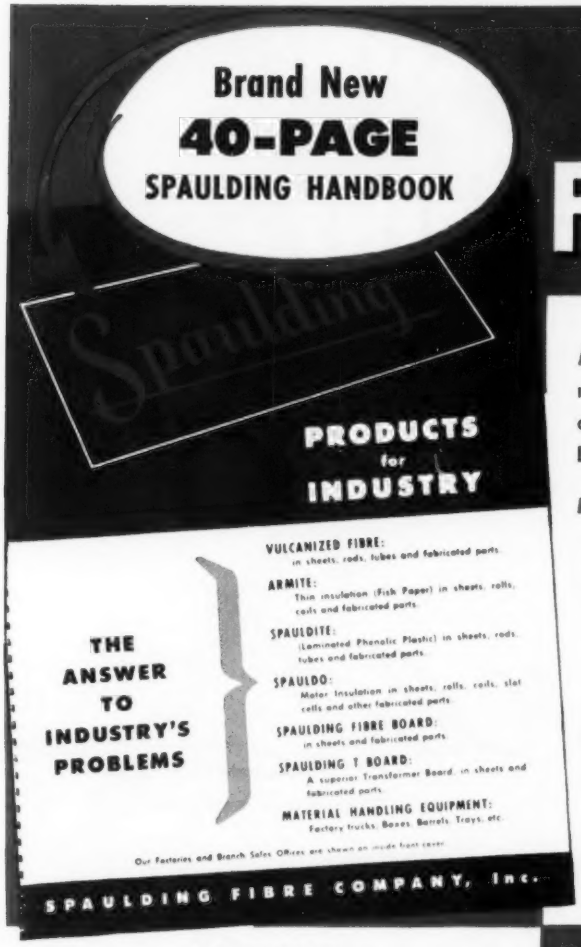
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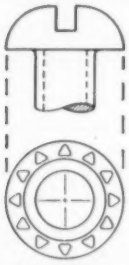
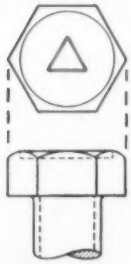


12 IMPRESSED TRIANGLES UNDER HEAD

COUNTERSUNK HEADS

6 IMPRESSED TRIANGLES UNDER HEAD

HEXAGON HEADS



1 EMBOSSED TRIANGLE ON TOP OF HEAD

Signed Like the hall mark on fine silverware, this triangle mark now impressed on all P-K Self-tapping Screws signifies the maker's pride of craftsmanship. This "signature" will serve for your protection against substitution.

Certified Now, the P-K triangle mark will certify every screw that bears it as a genuine Parker-Kalon product, made by the *originators* of Self-tapping Screws. Now, you can be sure, when you see this mark, that you are using the *only* Self-tapping Screws made with the accumulated "know-how" of 40 years of enterprising leadership

Guaranteed Now, identification goes beyond boxes or other containers and labels. The screw identifies itself, and when you see the P-K triangle mark you know it is the *guaranteed* screw, backed by the "Guarantee of Highest Quality" printed on every box. Look for the P-K triangle on the screws you buy and use. It's your one sure way to guard against job-slowing, parts-wasting screw failure . . . the way to make *planned* assembly savings *pay off*. Parker-Kalon Corporation, 200 Varick St., New York 14.

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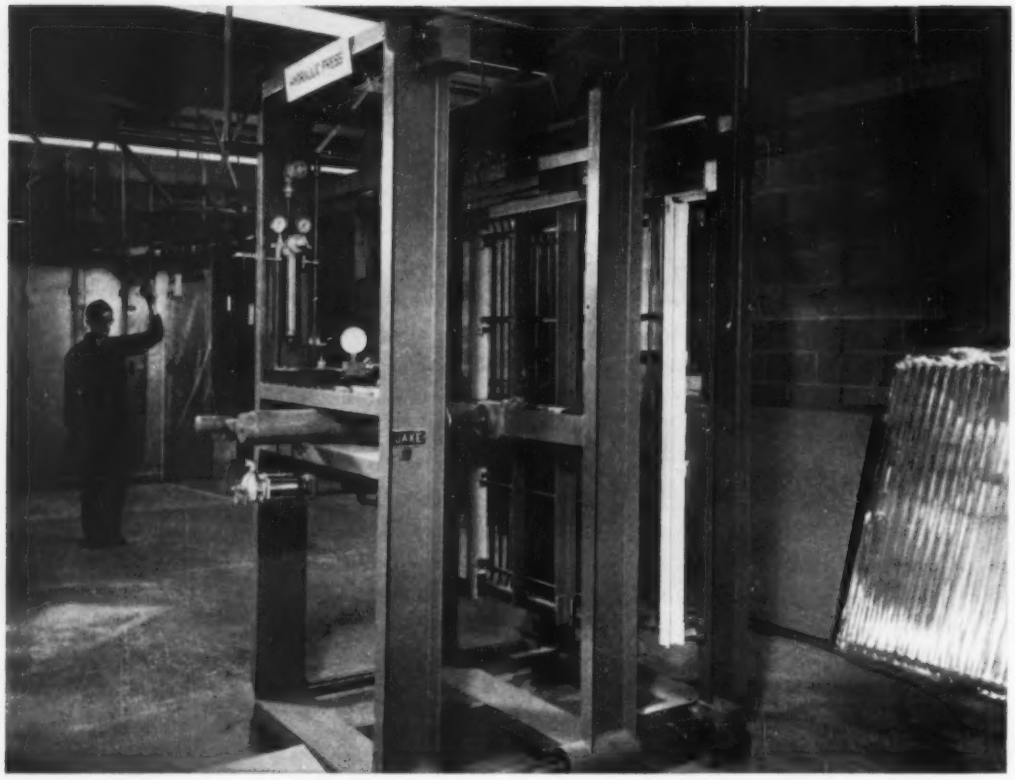


DAKE Custom Engineering saved $35,000 for this manufacturer on a special 34"x60"-bed press

In manufacturing bath enclosures it was necessary to put half-inch deep corrugations in large (34"x60") sheets of plexiglass. The forming had to be done quickly after the sheets had been softened in an oven.

Most suppliers approached about a press with bed large enough for 34"x60" sheets quoted in terms of a $40,000 to $50,000 investment. Then the manufacturer happily learned about Dake.

After placing his problem before Dake engineers, the result was the custom-engineered hydraulic press shown above . . . designed, fabricated and installed for less than 10% of what other manufacturers had quoted.

If you suspect that some of your production operations might be simplified with a custom-engineered press, it will pay *you* to consult Dake, too.

Dake Engine Company, 648 Seventh St., Grand Haven, Mich.

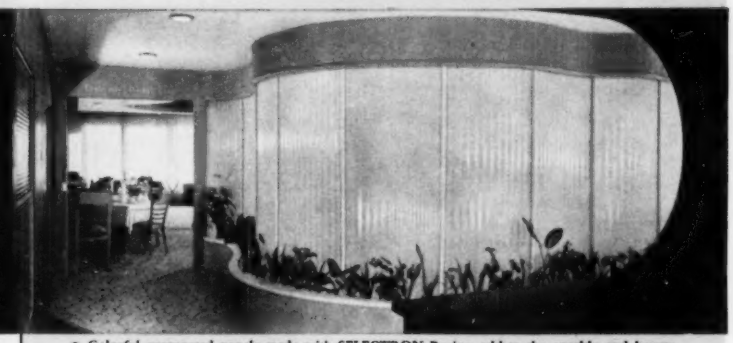
DAKE PRESSES

● SELECTRON Resins are used to make tough, translucent skylights that reduce installation and maintenance costs.

From skylights to decorative partitions—durable structural panels are made with . . .

Pittsburgh Selectron Polyester Resins

Now Ready For a Thousand New Uses!



● Colorful corrugated panels made with SELECTRON Resins, add to the sparkle and beauty of a country club dining room. *Photographs courtesy of the Corrulux Corporation, Houston, Texas.*

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH'S SELECTRON Polyester Resins are playing an important part in the lusty growth of revolutionary new materials for building and decorating. These versatile resins are being used by many makers of colorful panels for skylighting, side lighting and partitioning.

● **Among makers** of structural panels to whom Pittsburgh is supplying Selectron Resins are The Corrulux Corporation, Houston, Texas, The Alsynite Company of America, San Diego, Calif. and Portsmouth, Ohio, The Resolite Company, Zelienople, Pa., and the Presstite Engineering Company, St. Louis, Mo.

● **SELECTRON Resins** give these panels unusual weather resistance, easy moldability and colorability. Reinforcing fillers give them exceptional strength with low weight, impact toughness and dimensional stability even under severe stresses.

● **Being translucent,** these panels diffuse daylight without glare. They possess low thermal conductivity. They are shatter-resistant.

● **These panels** often cost half as much to install as conventional materials. They are practically maintenance free, being impervious to weather-wear, sunlight, heat, cold, mildew, humidity, rot and most chemicals and fumes.

● **SELECTRON Resins** offer endless possibilities to alert, progressive manufacturers. If you are designing a new product—or redesigning one you are now making—SELECTRON may help you make it lighter, stronger, more durable and, possibly, at lower cost. Call on us for advisory service. We'll be glad to have one of our engineers discuss your problems with you without cost or obligation.

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● Write, wire or phone today for our new booklet containing description of SELECTRON Polyester Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, 2000 Grant Building, Pittsburgh 19, Pa.

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- Fully automatic and foolproof
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- Vickers hydraulic equipment
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- Made in England
- Built to American screw thread standards
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SPECIFICATIONS

Cycles per hour (maximum)	1200
Material plasticized per hour (dependent upon shot size and material)	22 lb.
Area of injection plunger	2.074 sq. in.
Pressure on material at end of plunger	9100 lb./sq. in.
Total pressure on injection plunger	18850 lb.
Mould opens (adjustable)	9 in.
Maximum die space	7 in.
Minimum die space	3 in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	15 x 16 in.

DOWDING & DOLL LTD
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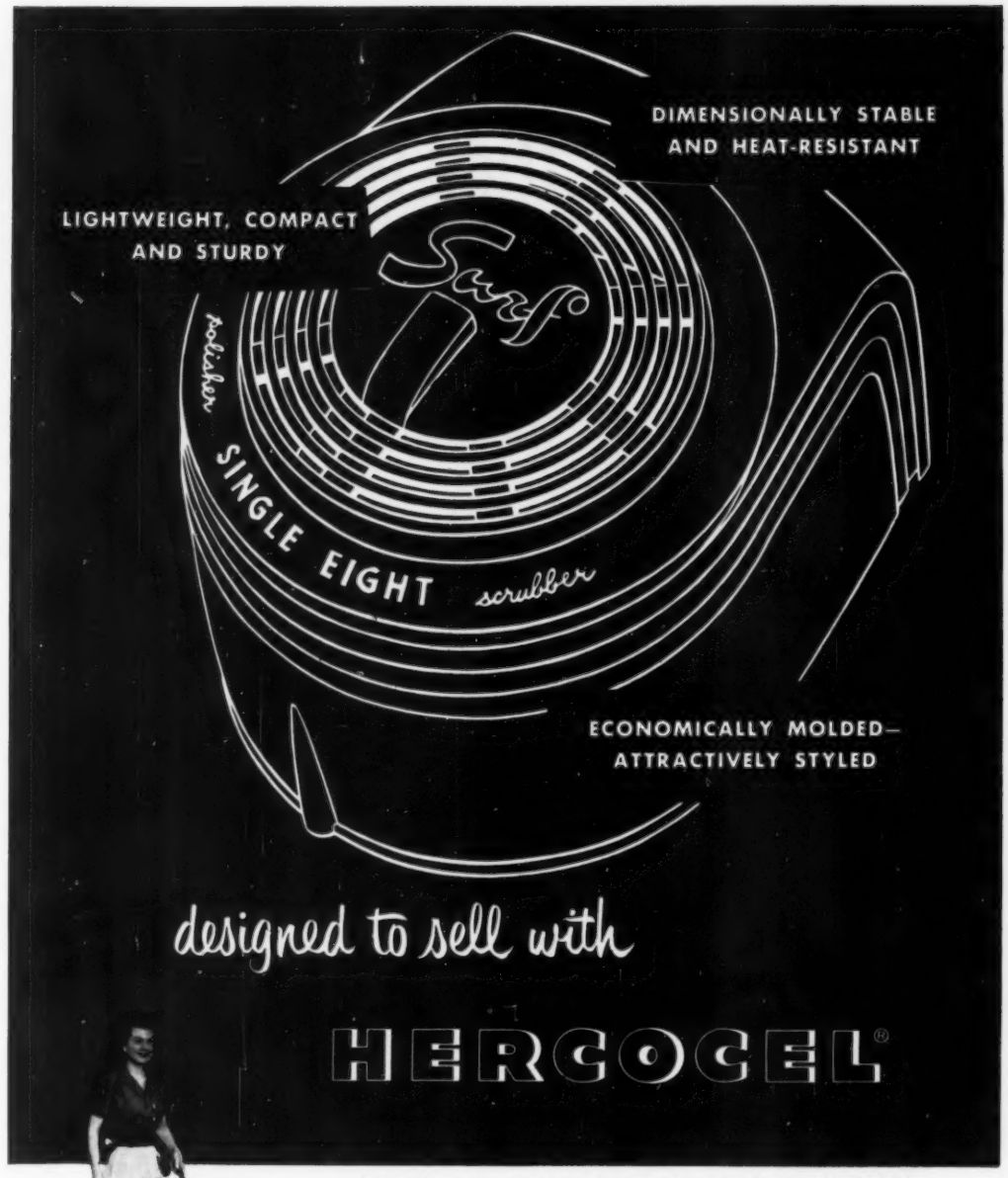

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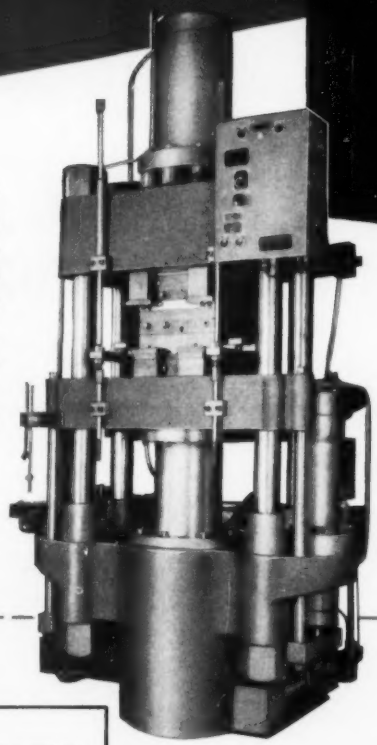

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Now Available! A Solution to Your Dicing Problems!

The CUMBERLAND DICING MACHINE

features

THE SIMPLEST, LEAST EXPENSIVE METHOD OF DICING YET DEVISED!

This new Cumberland dicing (or cubing) machine efficiently dices plastic sheet stock into a wide variety of cube sizes. Input speed ranges from 10 feet to 125 feet per minute.

A proven machine, the Cumberland dicer is a modified form of the well-known rotary chopping machine regularly used for many applications throughout the plastics industry. The new dicer has satisfactorily diced *millions* of pounds of plastics!

If you are interested in dicing plastic materials easily and inexpensively, you'll want to investigate the Cumberland dicing machine right away!

WRITE FOR COMPLETE TECHNICAL DETAILS!

USE THIS MACHINE FOR THESE OTHER APPLICATIONS, TOO!

1. Cut heavy vinylite slabs.
2. Cut continuously extruded scrap!
3. Cut side shear from calendering machines.
4. Produce pellets from continuous strands.

For details, request Bulletin 401.

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

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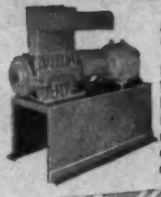
GRANULATING MACHINES (All Models)

Seven different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.



MODEL 18 GRANULATOR

Large capacity double-hung construction for heavy duty applications. Like all Cumberland machines, it is easy to adjust, dismantle, and clean.

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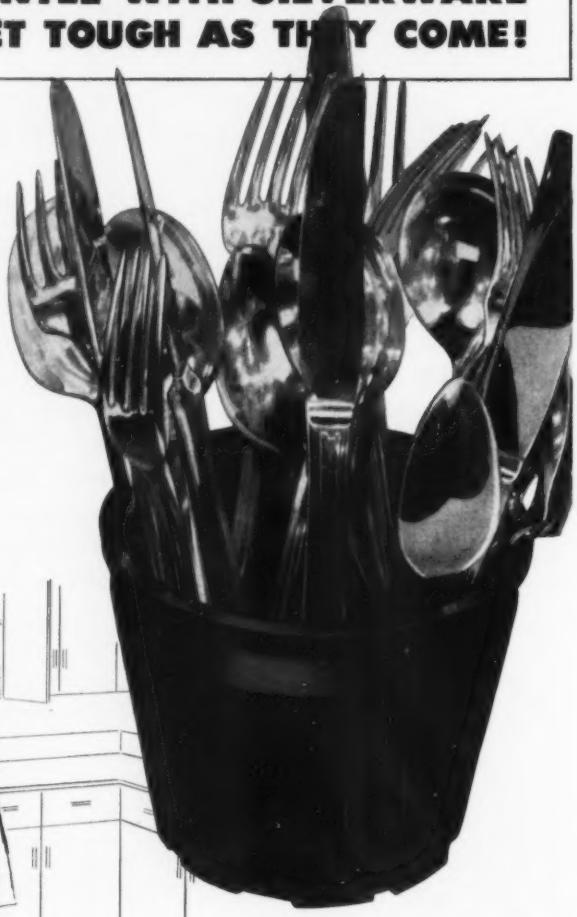
GENTLE WITH SILVERWARE -YET TOUGH AS THEY COME!



Hycar-phenolic compounds have many advantages that help improve products, bring cost-savings too. They impart extra toughness and shock-resistance that enable molded parts to withstand more than usual abuse. In processing, they provide better molding characteristics . . . easier flow in the mold than straight phenolics . . . resistance to cracking around metal inserts in the part.

One of the many Hycar rubber compounds may be just what you need to solve a product problem. For versatile Hycar is used as a base material . . . as a modifier for phenolic resins . . . as a plasticizer for polyvinyl resins . . . as an adhesive base . . . as a latex for coating or impregnating. For helpful technical bulletins and advice, write Dept. HV-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar-phenolic compound supplied by General Electric Company, Chemical Division, Pittsfield, Mass. Basket molded by Prolon Plastics Co., Florence, Mass. B. F. Goodrich Chemical Company supplies the Hycar American rubber only.

Hycar
Reg. U.S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Approximately 2000 Penn drawing dies like those shown are polished with 5 grams of Elgin DYMO Diamond Abrasive. Elgin Diamond is faster, cleaner and dies operate longer before sizing and polishing is again required.
ELGIN DIAMOND
COSTS LESS THAN
2 CENTS PER DIE!
. . . AT PENN BRASS and COPPER COMPANY of Erie, Pennsylvania, leading producer of tubing products. A 20% reduction in expensive die lubricating compounds and smoother tubing surface is also credited to the use of Elgin's DYMO-C® Diamond Abrasive in drawing die polishing operations.
Elgin Diamond, crushed, precision graded at Elgin and combined with an exclusive color identified vehicle in DYMO, will assure uniform, predictable polishing results and important savings in your plant. Be certain of the finest of fine finishes . . .
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Material Manufacturers—Plastic Compounders—Molders

GET THESE 8 COMBINED ADVANTAGES IN REDS AND YELLOWS FOR COLORING YOUR PLASTIC MATERIAL

REDS and YELLOWS

CADMOLITH COLORS

Glidden leadership in pigment research offers material manufacturers, compounders of new or old materials, plastic molders, or coaters a combination of advantages found in no other Red or Yellow pigments. These colorants, in Glidden CADMOLITH* Colors make your coloring job easier—give finest, most lasting colors in powders or plastic products made from them.

Specify Glidden CADMOLITH* Gain these 8 Superior Properties . . .

- Soft, and Easy to Grind
- Insoluble in all Vehicles
- Alkali and Acid-Resistant
- High Heat Resistance
- Non-Fading to Light
- Non-Bleeding
- Wide Range of Shades
- Opaque

SEND FOR THIS FOLDER giving complete details, with color chips. Write The Glidden Company, Chemicals • Pigments • Metals Division Union Commerce Building, Cleveland 14, Ohio.

*Trade Mark Registered

SUNOLITH* Lithopone

ZOPAQUE* Titanium Dioxide

TITANOLITH* Titanated Lithopone

QUALITY Glidden PRODUCTS

THE GLIDDEN COMPANY

CHEMICALS • PIGMENTS • METALS DIVISION

Baltimore, Md. Cambridge, Mass. Hammond, Ind. Oakland, Calif.

DE MATTIA MOLDING EQUIPMENT

FOR IMPROVED PRODUCTION IN THE MODERN MOLDING PLANT — De Mattia molding presses and granulators — are world famous for fine performance and sureness of operation. Rugged De Mattia construction refinements assure long, continuous service.

DE MATTIA MOLDING PRESSES

DE MATTIA 4 OUNCE VERTICAL

• A high efficiency, all hydraulic De Mattia Injection Molding Press featuring smooth fluid power for both injection and mold clamping operations. Design permits conversion for both compression and transfer work by use of a few low cost additions.

DE MATTIA 12 OUNCE HORIZONTAL

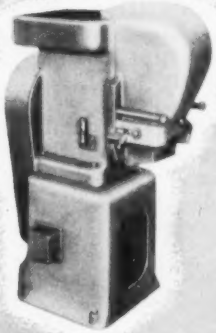
• The De Mattia Model C-1 Injection Molding Press combines the latest design advantages with the ultimate in molding performance. Features uniform hydraulic pressure on entire die face, high mold clamping pressure and exceptionally heavy tension members.

DE MATTIA GRANULATORS

DE MATTIA GRANULATOR No. 1

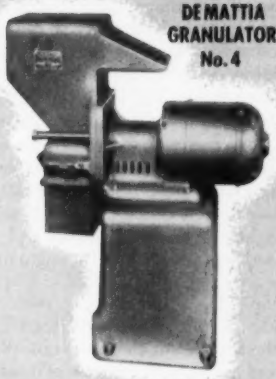
A simple, rugged and highly efficient granulator. Processes 200 lbs. per hour. Floor space required — 32" x 44"; net weight with motor — 600 lbs. approx. Features high grade roller bearings with positive seal.

DE MATTIA GRANULATOR No. 3



Salvages large chunks from heating cylinder, nozzle accumulations and tough molded pieces. Floor space — 32" x 18" x 45" high; net weight including motor 750 lbs. Heat treated alloys steel rotor.

DE MATTIA GRANULATOR No. 4



Especially recommended for installation along side the molding press. Available with or without base. Overall dimensions — 34" long, 12" wide, 23½" high (from bench). Hopper opening — 9" x 4½"; net weight 375 lbs.

New York Sales Office: 50 Church St.
Cable Address: Bromach, New York
Midwestern Representative: E. Maywald
189 West Madison St., Chicago 2, Illinois

DE MATTIA MACHINE and TOOL CO.

CLIFTON, NEW JERSEY

MOLDING PRESSES • GRANULATORS • MOLD MAKING

Arc Suppression

with complete safety!

Thermatron

T. M. Reg. U. S. Pat. Off.

takes an important step forward in high frequency sealing of vinyl plastics

Here's the THERMATRON Arc Suppressor . . . the most advanced unit of its type featuring complete stoppage of all damage to electrodes, dies and costly materials; It permits the generator to be used without buffers . . . a feature that means tremendous savings in equipment and replacement costs which can pay for the unit over and over again.

Small and compact, the Suppressor fits easily on top of the THERMATRON generator, taking no extra floor space. It is designed to be incorporated with generators now operating in the field.

Advantages are many . . . . With a response of *one-millionth* of a second, the Arc Suppressor works equally well on both small and large units from ¼ KW to 20 KW. A one dial operation, it has indicating lights to show that filament and high voltage are functioning normally —and another light to show when the unit has operated to prevent arc . . . And while preventing arc, the Suppressor also breaks the plate and grid line, making unintentional recyling impossible. It breaks the timer cycle, too, and the generator is reset automatically for the next operation.

Our engineers will gladly give you further particulars on this important new development in vinyl fabrication. For complete information, write to Dept. 70.

Thermatron

DIVISION

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

SALES DEPT: 251 W. 19th St., New York 11, N. Y. • FACTORY: 84 N. 9th St., Brooklyn 11, N. Y.

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Here's a new, modified Polystyrene for large moldings

KOPPERS MC 405 is used for the interior panels of both doors, the freezer compartment and for door shelves in this latest Admiral Dual-Temp Refrigerator. These are excellent examples of the large, accurate moldings which can be formed quickly and easily with this new modified polystyrene.

Each of the sections mentioned above was injection-molded in a single operation, and the speed and ease of molding resulted in a far lower unit cost than would have been possible with conventional construction methods and materials. The light weight of the sections effected substantial savings in freight and storage costs. The MC 405 moldings combine good resistance to shock and impact, dimensional stability, a smooth, attractive finish and low heat conductivity.

The characteristics of Koppers MC 405 suggest it as the ideal construction material for trays, cabinets, strips and other refrigerator parts as well as for housewares, battery cases, toys, containers and displays.

Write today for further information about MC 405 and Koppers other Modified Polystyrenes. If you desire, a Koppers representative will gladly call to discuss the suitability of any of Koppers Polystyrenes for your particular product applications.

Koppers Plastics Make Many Products Better and Many Better Products Possible

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KOPPERS COMPANY, INC., Chemical Division, Dept. MP-23, PITTSBURGH 19, PA.

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · CHICAGO · DETROIT · LOS ANGELES

YOU NAME IT

Switch Block

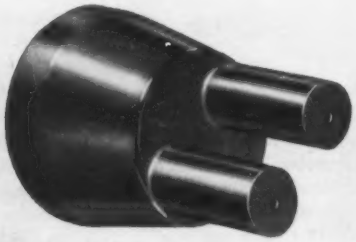
Compression molded of impact phenolic. Over 200 critical dimensions in the block were held to ± .001". Molding conditions were carefully controlled to prevent distortion and insure dimensional accuracy.

. . . WE'LL MOLD IT

Fire Extinguisher Nozzle

Compression molded of Melamine with fabric filler. Must withstand considerable physical abuse. The Melamine has high mechanical strength required by the application.

. . . TO YOUR SPECS



Timer Light Housing

Injection molded of polystyrene. Low unit cost was made possible by the use of this fast setting thermo-plastic material.

Tell us what you want . . . leave the rest to us. We are well equipped by experience to select the right material for the job . . . and have the engineering staff and facilities to design and build precision molds. If your product, or any of its components, can be produced in plastics, write or call us for full details on our complete molding service.

P. R. MALLORY PLASTICS, INC.
3670 MILWAUKEE AVE. • CHICAGO 41, ILLINOIS

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specialists in *Reprocessed* plastics

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MUEHLSTEIN specializes in reprocessed plastics. Their technical staff is at your service.

Further information and samples on request.

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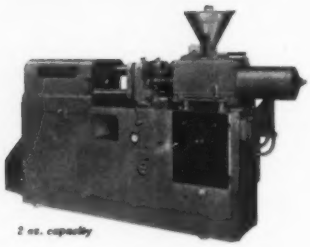
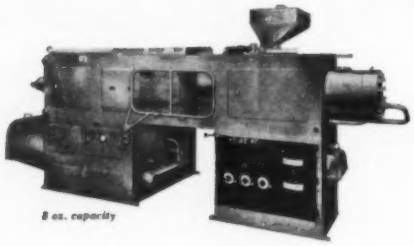


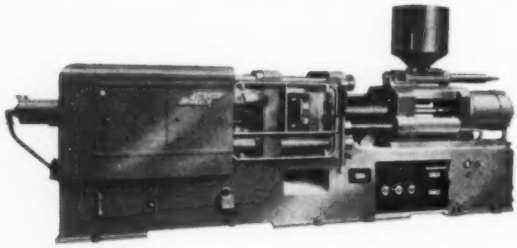
2 oz. capacity

There's one name outstanding



8 oz. capacity

for Injection Moulding Machines-



16 oz. capacity

The PROJECTILE & ENGINEERING
COMPANY LIMITED

PECO Injection Molding Machines are supplied in 2, 4, 8 and 16 oz. capacities. They are self-contained with automatic cycle and are hydraulically operated, and have a high plasticising capacity and rate of injection. Mold-locking pressure and platen area enable them to operate at a high rate production. Full particulars of the PECO range of Injection Molding Machines and Molds will be sent on request.

MOLDS. Expert designers and mold makers are employed and molds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for molds and medallions—the plant includes 3,000 ton hobbing plant. Master hobs to customers' samples made as required.

ACRE STREET, BATTERSEA, LONDON, S.W.8. ENGLAND

Telegrams: "Profectus, Claproad, London."

BRITISH MADE PECO PRODUCTS

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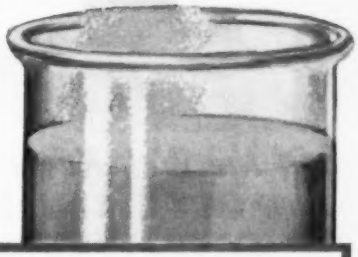
a dry polyester for low-viscosity laminating resins... stable... fast-mixing... readily applied

For general laminating purposes, you'll find every quality you require in the new Atlac® LV Dry Polyester Resin. It dissolves easily in styrene, making a low viscosity solution which is easily applied by spray, dip or brush. Particularly valuable for low-temperature curing.

Atlac LV is supplied in the dry form without styrene . . . never cures during storage. This unique stability ends many of your production headaches. You can set your optimum curing cycle and hold it week after week—no need to change to allow for shelf aging.

Its low degree of color and high clarity make Atlac LV your best choice for quality of laminated products. Best of all, Atlac LV is priced right. For complete facts, write or call Atlas today.



CHOOSE ATLAC DRY POLYESTER RESINS FOR OTHER APPLICATIONS

ATLAC 370
Binder for preforms: now available in color-matched shades that eliminate binder spotting.

ATLAC 382
For laminating glass fiber cloth or mat, and for dry or putty type glass filled molding compounds.

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NOW a complete Line of PLASTICIZERS

New Odorless, High-Purity
DICAPRYL PHTHALATE

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DIBUTYL SEBACATE

Specific Gravity	Pounds per Gallon	Free Acidity	Color (Hazen)	Ester Content	Flash Point	Fire Point	Sap. No.	Mol. Wt.
.975	8.22	0.015	125	99.7%	425°f.	485°f.	287.1	390
1.045	8.71	0.010	50 max.	100%	360°f.	395°f.	403.2	278.3
.965	8.04	0.010	100 max.	99.7%	457°f.	510°f.	251.2	446.7
.911	7.58	0.010	75 max.	99.7%	455°f.	490°f.	262.9	426.7
.936	7.80	0.010	50 max.	100%	390°f.	425°f.	356.8	314.5

and the Well-Known **"POLLY TWINS"**

POLYCIZER 332 -- Dioctyl Adipate

POLYCIZER 162 -- Dioctyl Phthalate

also **TRICRESYL PHOSPHATES**

2 GRADES
- **LINDOL**-from Coal Tar Cresylic Acid
- **CELLUFLEX**-from Petroleum Cresylic Acid

* Reg. U. S. Pat. Off.

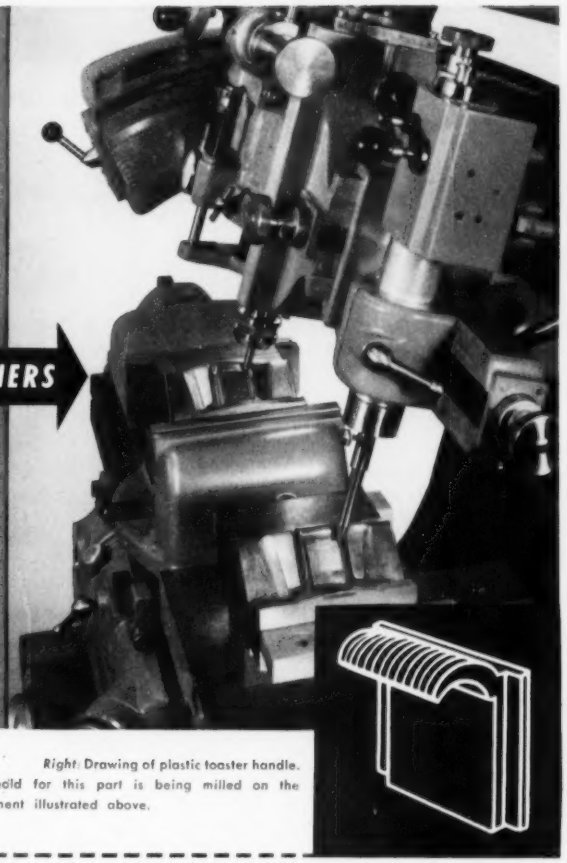
Write for complete data on these PLASTICIZERS

HARWICK STANDARD CHEMICAL CO.

AKRON, OHIO

BRANCHES: BOSTON, TRENTON, CHICAGO, LOS ANGELES

The cutter and tracing head of this CINCINNATI 8" x 18" Tool and Die Miller has been swiveled a few degrees to mill corners and the straight walls in a mold for a plastic handle.



IT REACHES THE TOUGH CORNERS

and ELIMINATES A LOT OF HAND FINISHING

Right: Drawing of plastic toaster handle. The mold for this part is being milled on the equipment illustrated above.

CINCINNATI 8" x 18" Tool and Die Milling Machine. Catalog No. M-1731 contains complete specifications. Write for a copy.

● Hard-to-get-at corners of a mold need not be such a big factor in the cost of hand finishing. Clean them out accurately on the die-sinking machine, and you will see hand finishing costs drop sharply. This is one of the advantages offered by CINCINNATI 8" x 18" Tool and Die Millers. For milling open-end square corners, the cutter spindle and tracing head may be swiveled as a unit 15° front or 35° back. ¶ Tracing and milling then proceed in the usual manner. The setup above illustrates this feature in milling a mold for a plastic handle. Other CINCINNATI 8" x 18" features are equally important in making plastic molds: handwheel table traverse with anti-friction screw; light pressure, automatic tracing; integral slotting attachment, if desired. Complete data may be obtained by writing for catalog No. M-1731.

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • [illegible]
MACHINES • METAL [illegible]
SPECIAL [illegible]

Notes on a Calendar Pad:

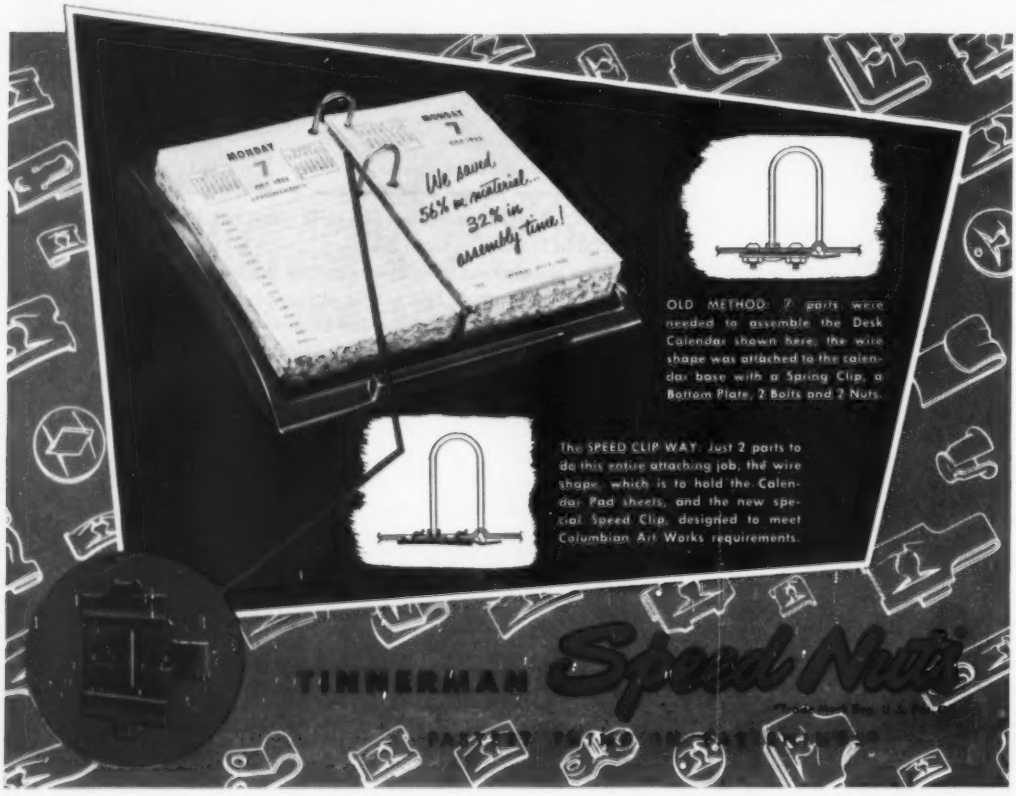
"We saved 56% on material... 32% in assembly time!"

Desk Calendar Manufacturer makes "up-to-date" Savings by switching to Tinnerman Speed Clips

Here's how Columbian Art Works, of Milwaukee, Wisconsin, makers of quality desk calendars, recently checked their own production methods and picked up this amazing time and material savings! For many years they used 6 parts, plus a wire arch brace, to assemble and fasten one of their popular calendar pad models. Today . . . the Speed Clip way, this entire operation is done with 2 parts—the wire shape, and one multiple-function, special Speed Clip. The result is a saving of 32% in assembly time and 56% in material costs!

Savings like these are worth thinking about! Before too many sheets are torn from your calendar pad, make a date with your Tinnerman representative for expert advice on fastener engineering. There may be a "SAVINGS STORY" in your fastening assemblies. Meanwhile, write for a copy of the FREE booklet: "SAVINGS STORIES", TINNERMAN PRODUCTS, INC., Dept. 12, Box 6688, Cleveland 1, O. *In Canada:* Dominion Fasteners, Ltd., Hamilton, Ontario. *In Great Britain:* Simmonds Aerocessories Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S.A., 7 rue Henri Barbusse, Levallois (Seine), France.

Whatever you make—from Calendar Pads to Clothes Dryers—think first of TINNERMAN for better Fastening Engineering.


MONDAY
7
We saved 56% on material... 32% in assembly time!
OLD METHOD: 7 parts were needed to assemble the Desk Calendar shown here, the wire shape was attached to the calendar base with a Spring Clip, a Bottom Plate, 2 Bolts and 2 Nuts.
The SPEED CLIP WAY: Just 2 parts to do this entire attaching job, the wire shape, which is to hold the Calendar Pad sheets, and the new special Speed Clip, designed to meet Columbian Art Works requirements.
TINNERMAN Speed Nut

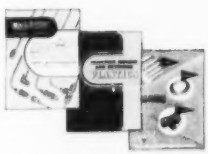
Skillful molding tells a gripping story

Among mimeograph artists, the hand is now quicker—and so is the eye, thanks to these plastic stylus handles. Their carefully developed and exactly executed non-roll design gives them a firmer grip and better balance which results in greater ease and speed for artists. The weight is ideal and durability assured through the skillful molding of the *correct* plastic material. Vivid, distinctive colors make the styli types quickly identifiable, thereby saving the artist's time.

Mimeograph stylus handles molded for A. B. Dick Company, Chicago

The production of these stylus handles naturally presented their own unique engineering and molding problems. But the end results: better performance, smarter appearance, more sales appeal are typical of all Mills plastic products, created in America's finest, most modern molding plant.

One of our representatives will gladly show you how to make sure your plastic products have these important extra values. Tell us today when he may call.



*Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about Cello-phane *, piping, tubing and fittings, write for circulars containing data and illustrations.*
**Trade Mark Registered.*

ELMER E. MILLS CORPORATION

INJECTION MOLDED and EXTRUDED Thermo Plastic Materials including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Methacrylates, Styrene, Vinyls, Polyethene Chloride, Cello-phane *

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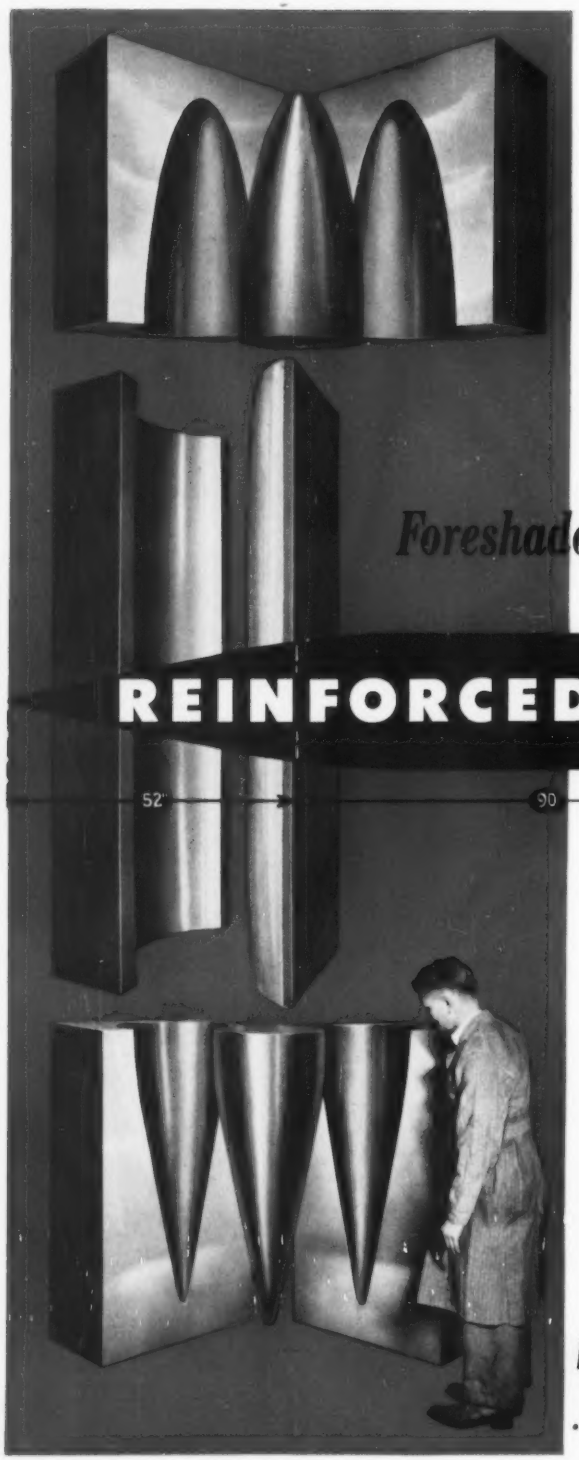

These gigantic mold parts are now nearing completion in the **MPc** tool room. They will be used to mold the U.S. Air Forces droppable fuel tank... 180 inches long, 23 inches in diameter, with capacity up to 250 gallons. The molding material will be glass fibre impregnated with polyester resins.

This immense molding may well become known as the prototype of the enormously larger and stronger molded pieces which can now be made with reinforced plastics. Because of **MPc's** large press facilities, it is appropriate that the production of this pace-making molding should be assigned to the organization which has consistently paced the advance to ever larger plastic moldings.

Foreshadowing the Future of

REINFORCED PLASTICS

52" 90 38"

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LARGE PLASTIC MOLDINGS of the SPI

FREE "Data Book of MPc Facilities," an engineering-eye view of MPc press capacities and other production facilities... together with a survey of MPc special skills available for your use. Write for your copy.

PLASTICS DIVISION
MOLDED MPc PRODUCTS
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...Pace-Makers in Plastics Molding

"let St. George do it!"
when you need

industrial fabrics of **woven glass**

for coating, laminating, any industrial purpose...

Come to St. George for the synthetic fabrics that are proving themselves throughout industry today! Our facilities are both flexible and complete, our weaving craftsmanship the result of long experience. And if you have a special industrial fabric problem — let us show you how efficiently inquiring minds and willing hands can solve it!

Send for complete information.

Address: **INDUSTRIAL DIVISION**

St. George Textile Corp.

119 West 40th Street, New York

Industrial who's who!

St. George customers make up a blue-ribbon roster of the country's largest industries. Through the years they have been coming to St. George for specialized fabrics in **glass, nylon, dynel, vinyon** and other synthetics. Take advantage of the complete facilities of a leader in the field—

"Let St. George do it!"

HIGH QUALITY at LOW COST

for reinforced polyesters

If you're seeking ways to get better polyesters at low cost, let us recommend the right DIAMOND Precipitated Calcium Carbonate for your product.

You'll get smoother surfaces, no cracks, no evidence of glass fibers when DIAMOND Carbonates are mixed with catalyzed, glass-reinforced polyesters. And your product gets improved wet strength and reduced shrinkage.

All these at lower volume cost.

DIAMOND offers these precipitated calcium carbonates for reinforced polyesters:

Surfex® MM—coated with 1% resin; particle size about 5 microns.

Kalite®—coated with 1% stearic acid; size about one micron.

Suspenso®—same as Surfex MM, but uncoated.

Multifex® MM—uncoated; particle size about .06 micron.

Write for DIAMOND technical bulletin: *The Use of Precipitated Calcium Carbonates in Reinforced Plastics.*

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FOR THE RUBBER AND PLASTICS INDUSTRIES

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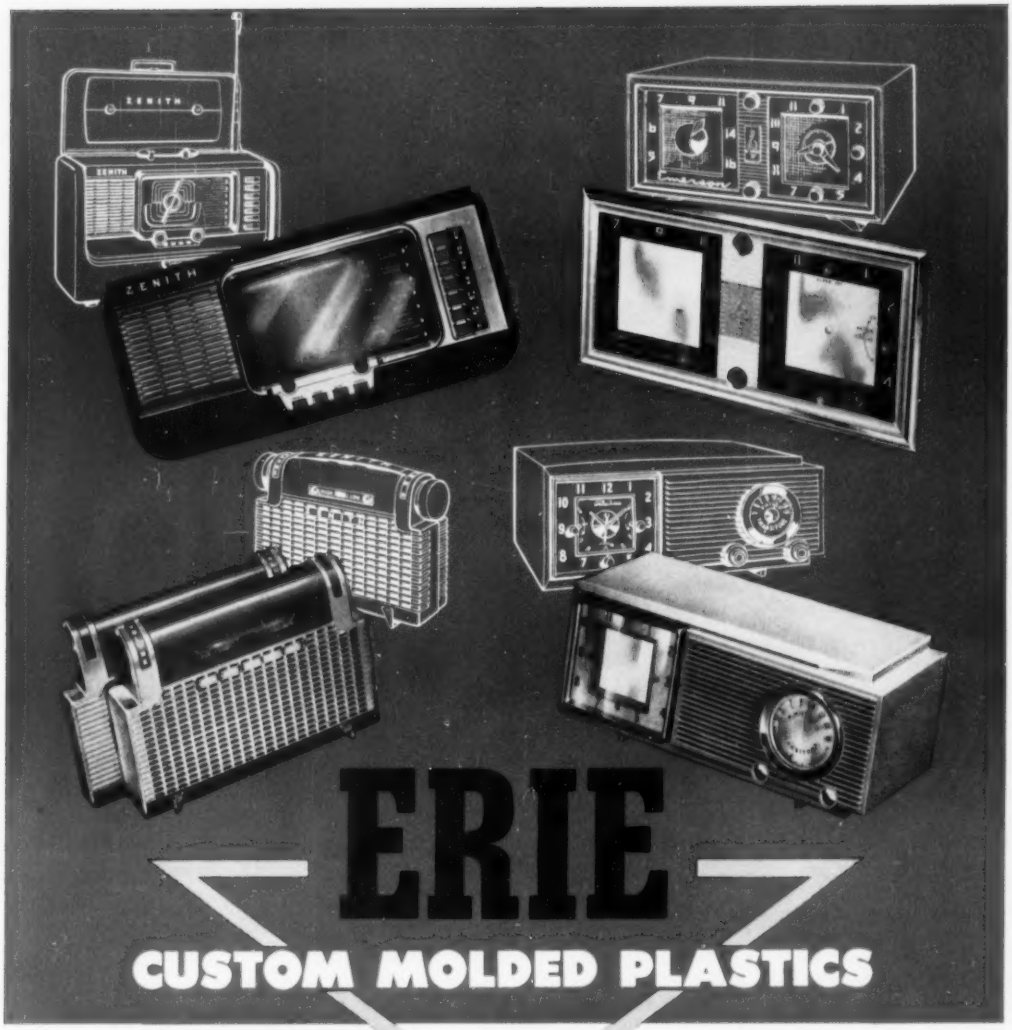

for portable and clock radios

A portable or clock radio is a personal possession . . . as individual as a watch. Styling ranks in importance with performance . . . custom molding is called on to do the outstanding, and is high-lighted with the imperishable beauty of three dimensional plastics.

Leading manufacturers such as Philco, Zenith and Emerson, whose cases are illustrated above, have found that Erie, pioneer in custom injection molding, has kept pace with every new development in materials and in molding processes, to match the best in radio reception with the most striking in eye appeal.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

TRADE ERIE MARK
RESISTOR CORP.

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In 70 years of glassmaking, Pittsburgh Plate Glass Company has mastered the intricacies of making glass in many forms . . . has developed many techniques and new processes that have greatly increased the usefulness of glass. That's why, when it came to the relatively new art of drawing glass into tiny, tiny fibers, PPG's skilled hands took to it readily.

Pittsburgh Plate Glass Company is manufacturing Fiber Glass Superfine Insulation, and Yarns, Strands and Roving to the highest standards of the industry. But in addition to product excellence, PPG offers the experience in handling the requirements of customers which eliminates many problems that might otherwise disrupt smooth operations.

If you use Fiber Glass—or any of the materials which Fiber Glass is so rapidly replacing—investigate PPG's facilities for serving you. Pittsburgh Plate Glass Company, Fiber Glass Division, 632 Duquesne Way, Pittsburgh 22, Pa. District Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

70 years of leadership

Many of the most important developments in glass manufacture are the result of continual research by Pittsburgh Plate Glass Company. Among these diverse achievements are

—the nation's first commercially successful plate glass plant

—the origination of Hi-Test Safety Glass

—Carrara structural glass

—massive windows for atomic research laboratories

Now research is being stepped up and the glassmaking skills acquired through the years are being devoted to the making of Fiber Glass. Your business may be among those to profit first from this program—so why not consult with PPG representatives now? Your inquiries will be welcomed.

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PITTSBURGH PLATE GLASS COMPANY

HERE'S WHY MIDWEST PLASTICS CO. PLACED THEIR ORDER FOR

a fourth NRM EXTRUDER

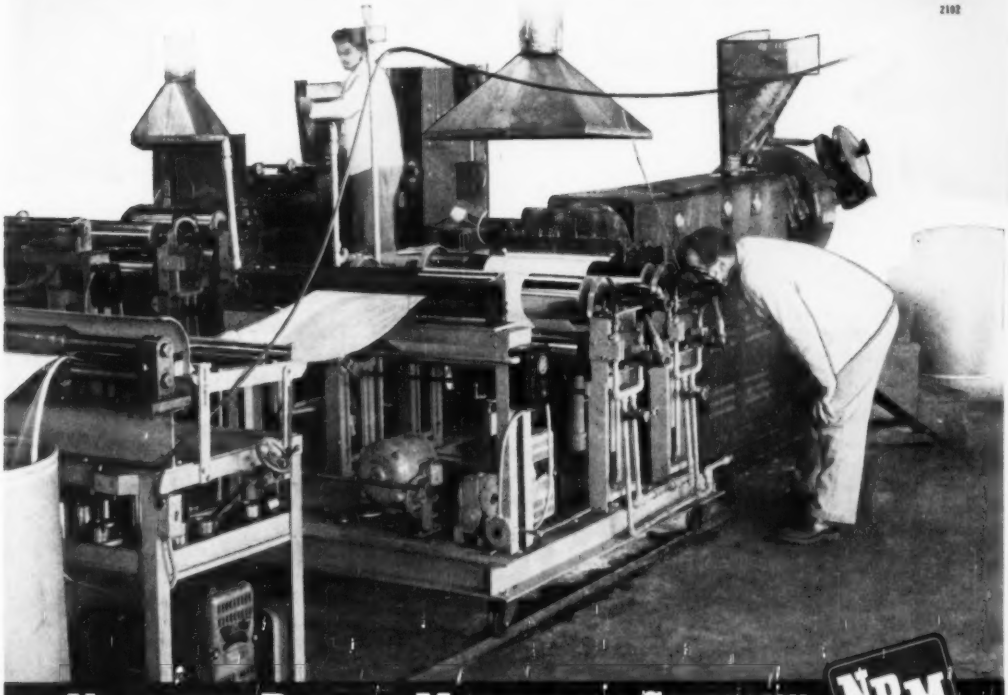
"The first extruder we ever owned was a used 2½" NRM" wrote C. C. Whitacre, President, Midwest Plastics Co., "In fact, that's how we started in business just ten years ago — on a used NRM and a short shoe string. The unfailing production from that used NRM told us better than words why NRM was tops in the field of extruders. We've just recently installed our third NRM—and placed our order for a fourth.

We're glad NRM has played a part in the growth of Midwest Plastics Co. In ten short years Midwest has become a major producer of extruded sheet plastics. Their big new plant in Chicago Heights is already beginning to look too small for their constantly growing volume.

The leaders in the field of plastics extrusion turn naturally to NRM, the leader in the field of plastics extruders. NRM built the first extruder especially designed for thermoplastics . . . designed the first electrically heated extruder . . . the "torpedo type" feed screw . . . developed balanced heat control . . . and the quick opening die gate.

Weigh this impressive record of "firsts" in extruder design, with the proved performance of NRM extruders the world over — and we're sure your next extruder will be "another NRM."

2102



NATIONAL RUBBER MACHINERY COMPANY NRM

Creative Engineering

General Offices & Engineering Laboratories: Akron 8, Ohio

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CHEMICALS – PLASTICS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

WITH plastic laminates finding wider and wider application throughout many industries, the maintenance of product quality under mass production technique becomes a prime requisite for a hydraulic press.

One of the main reasons why so many plastics manufacturers insist on an R. D. Wood Press is because of the R. D. Wood Heating Platen: Parallelism is held to extremely close limits within size ranges of 7′ x 34′ or 8′ x 24′. Unfailing uniform heat distribution is achieved. And finishes range from smooth tool to high polish, worked on specially processed fire box steel plate.

As for the press shown here, it is semi-automatic; operates at 2700 psi maximum working pressure, and is equipped with a loading and unloading elevator. The ten 4″ opening, press platens measure 42″ x 83″. Top and bottom platens are steam heated grid type to prevent excessive heat transfer from the working steam platens to the top and moving platens. The setting at the panel board automatically controls pressure, blow down, and the heating and cooling operations . . . providing the precision control that assures you of repetitive production of highest quality plastic laminates.

For data on the many types, sizes and pressure ranges of R. D. Wood Hydraulic Presses, write for catalog sheets—or get in touch with R. D. Wood sales engineers.

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. . . PIONEERED OVER 10 YEARS AGO BY OWENS-CORNING FIBERGLAS!

Radomes, they're called . . . these Fiberglas*-polyester "contact lenses" that high-speed planes wear to protect their radar eyes. And for more than 10 years—ever since the first one during the early days of World War II—they've been made with Owens-Corning Fiberglas reinforcements.

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There's no substitute for experience. And that's one of the reasons why, today, when molders think of Fiberglas, they automatically think of Owens-Corning . . . more than 15 years one of the pioneers in the reinforced plastics field.

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Short strands bonded into mat form.

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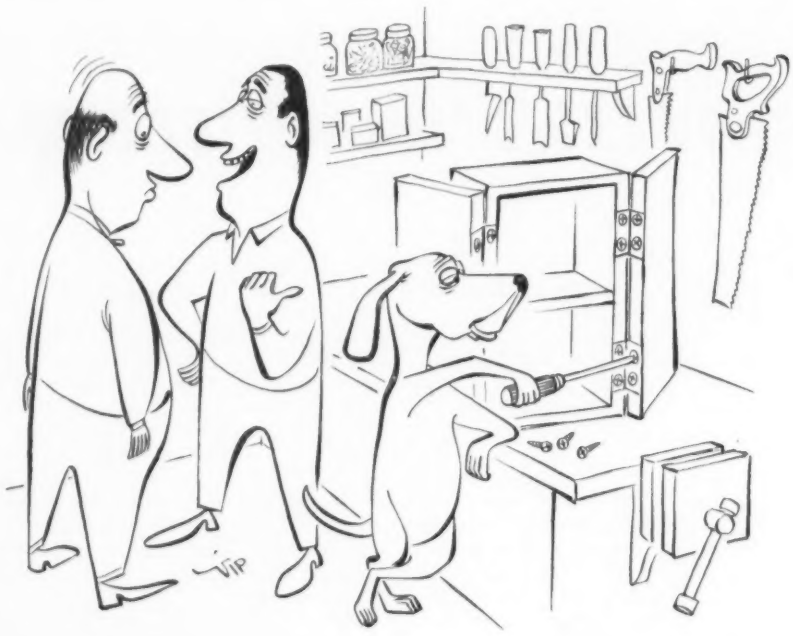
For heavy-duty use, maximum strength

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

DON'T FORGET the Eighth Annual Meeting of the Reinforced Plastics Division, S.P.I., at the Shoreham Hotel, Washington, D. C., Feb. 18, 19, 20!

What's Screwy? *by Phillips*



"Oh, he's not so smart. It's just that those Phillips Screws are so easy to drive."

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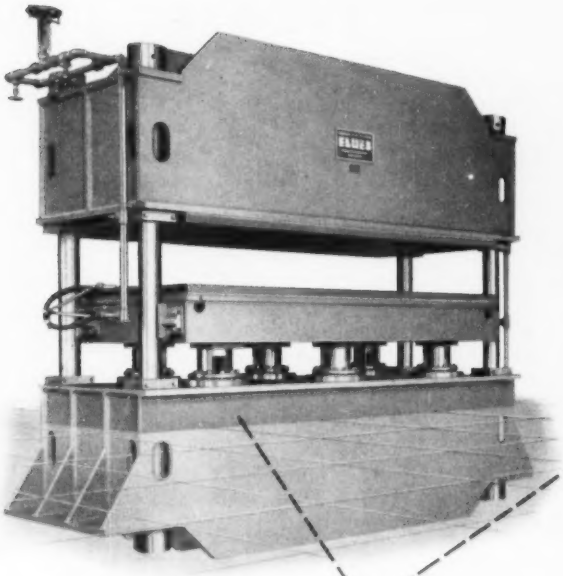
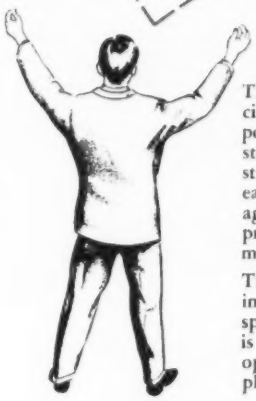


PUT YOUR "Pressing Problems" UP TO ELMES

Elmes 450-Ton Hot Plate Press

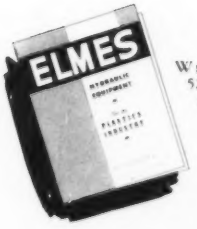
Hot Plate Dimensions: 106" L-R x 55" F-B
Stroke and Opening: 14"



Custom-built ELMES Hot Plate Press molds low-pressure polyester resins

This Elmes 450-Ton Hot Plate Press has been designed specifically to customer requirements for molding of low-pressure polyester resins. Construction is almost entirely of welded steel. Crown, bed, platen are heavy, one-piece weldments, fully stress relieved. Six single acting cylinders, of 75-tons capacity each, are set into the press bed, unrestrained. Rams bear against finished pads beneath the moving platen, and the press system is arranged so that only the two center cylinders may be actuated if desired.

The hydraulic system is self-contained. A dual-pressure pumping unit provides a high closing speed and moderate pressing speed. Gravity returns the platen downward. Press operation is completely pushbutton controlled. During semi-automatic operation an adjustable timer effects press opening upon completion of the work cycle.



Write for Bulletin 5200-A "Elmes Hydraulic Equipment for the Plastics Industry."

WHAT ARE YOUR REQUIREMENTS IN PLASTICS MOLDING PRESSES?

Elmes designs and builds a *complete line* of presses for the plastics molding industry. Whatever your requirements—compression or transfer molding presses, small production or laboratory presses, in standard designs or custom-built to specifications—it will pay you in profits to *"put your pressing problems up to Elmes."* Why not discuss your needs with our engineering staff? There is no obligation whatsoever.

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a superior non-woven fabric for laminating

Because of its completely random distribution of fibers, Lantuck non-woven fabric gives laminates equal strength in all horizontal directions and exceptional machineability at high cutting speeds. It also imparts a high degree of abrasion resistance. New, improved Lantuck is recommended as an economical filler for fine gears, textile bobbin heads and other laminates requiring sharp projections or edges, mirror-like machined surfaces and superior mechanical strength.

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PARAPLEX G-62

Boosts Stability in Vinyl Products

Excellent heat resistance and sunlight resistance are two of the major contributions of PARAPLEX G-62, a newly developed plasticizer-stabilizer for vinyl resins. Fadeometer tests still in progress show no discoloration or embrittlement of sample stocks after 1200 hour exposure. Control stocks containing only phthalate-type plasticizers failed at 300-400 hours in these tests. Window exposures confirm the added stability of PARAPLEX G-62 stocks, showing no evidence of incompatibility after many months.

The stabilizing effect of PARAPLEX G-62 also permits fast, high-temperature processing without discoloration. Savings in stabilizer costs thus can be added to the already-low price of PARAPLEX G-62.

PARAPLEX G-62 is a plasticizer of low volatility, and it resists extraction by oil, gasoline, and soap and water. These properties, together with its stabilizing effect, make PARAPLEX G-62 a highly permanent plasticizer.

For convincing proof of its unusual combination of properties, write for a sample.

There's a PARAPLEX or MONOPLEX plasticizer for your vinyl needs. Send for your copy of this 43-page plasticizer manual.

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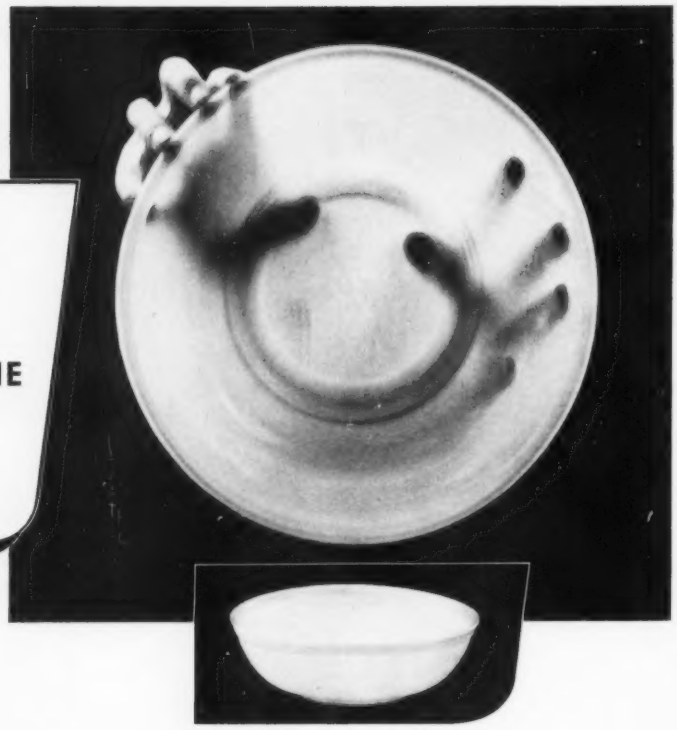


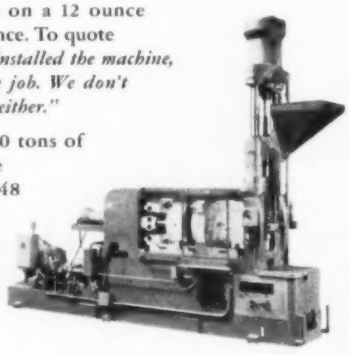
LOOK!

108 SQ. INS. OF POLYETHYLENE ON A 12 OZ. LESTER

. . . At Plastray Corporation in Detroit—another all-Lester shop—they're showing what can be done with Lester machines. They had done a lot of polyethylene molding on their 4 ounce and 20 ounce Lesters, when the job of running this 11-3/4" diameter, 7-1/4 ounce polyethylene bowl came their way. Without hesitation, they scheduled the job for the L-3-12 ounce Lester they had on order.

Now, that's a pretty big area of polyethylene to run on a 12 ounce machine. However, their confidence was based on experience. To quote Mr. Douglas L. Jocelyn, president of Plastray, *"We simply installed the machine, put the mold in, and started running production on the job. We don't expect any trouble with our Lesters—and we don't have any, either."*

The 12 ounce Lester is rated in polystyrene and has 350 tons of locking pressure. Write for complete specifications on the machine whose capacity is suited to your needs—4 to 48 ounces. And ask for a free copy of the "Lester Press", the Lester-Phoenix house organ filled with factual molding information.



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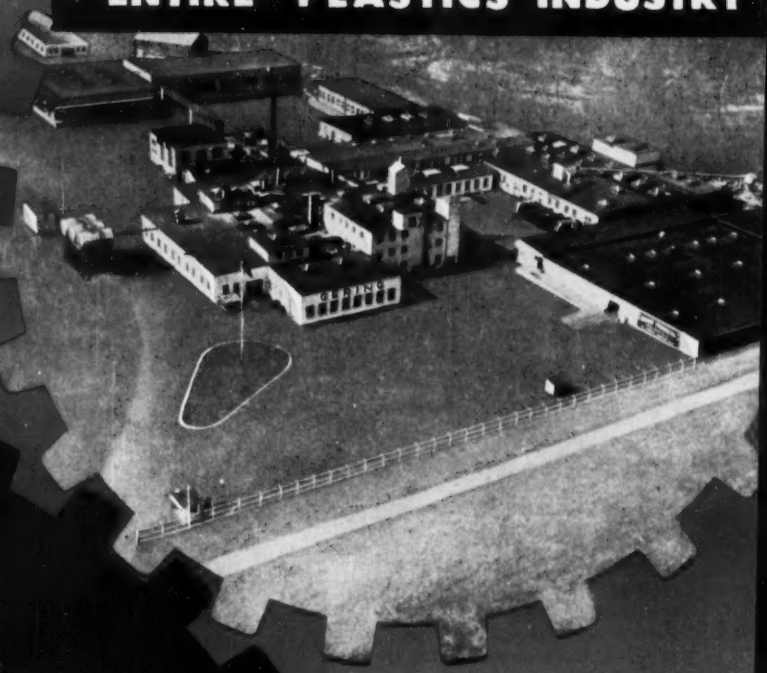

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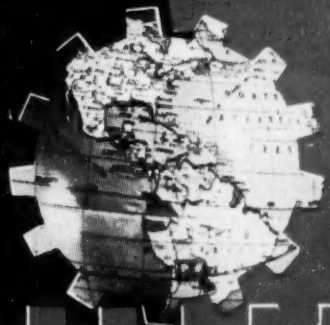

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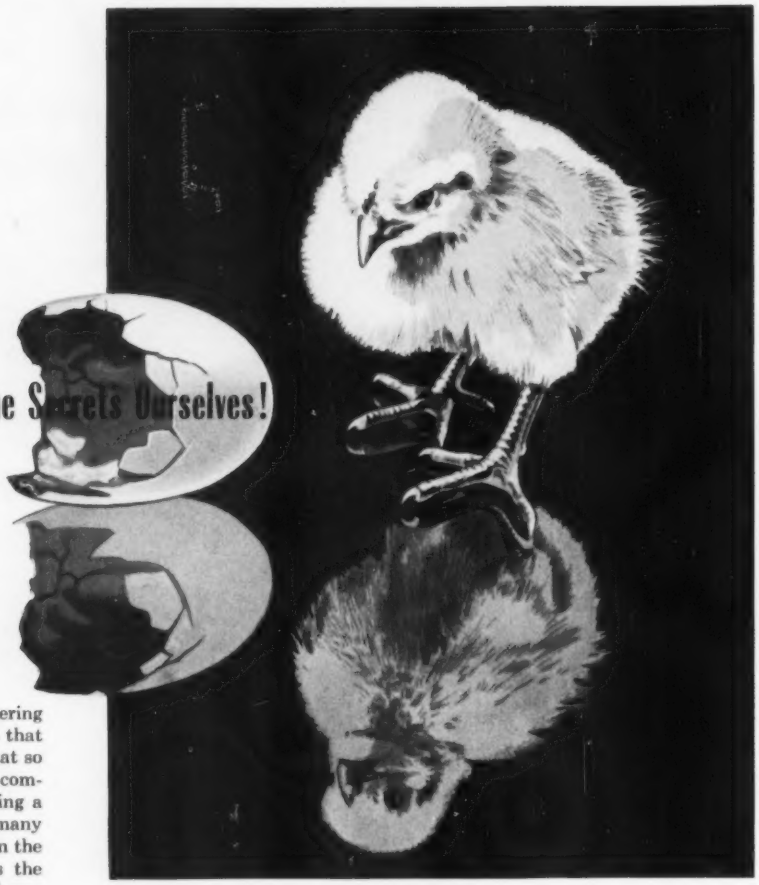

We've Hatched Some Secrets Ourselves!

PERHAPS IT IS the pioneering spirit of Welding Engineers that is responsible for the fact that so many of our custom-fitted compounder-extruders are making a success of secret processes in many plants of America's leaders in the plastics field. Perhaps it is the capacity of these specialized machines to compound and extrude, with or without extraction, hard-to-process materials. There is no doubt that Welding Engineers' dual worm design with its combination flexibility is the outstanding reason for the long record of successful operations credited to our compounder-extruders.

We've hatched some interesting secrets ourselves in the development of equipment that blended perfectly with the production problems of our customers. All this adds up to unique experience and manufacturing ability . . . and a proven record of performance you should know about before you invest in any equipment for any combination of compounding, extracting or extruding.

Secret process, or no, Welding Engineers has the money-saving, time-saving, space-saving ONE-OPERATION answer. We appreciate the opportunity of working with you or your engineering staff.

Write today for your copy of our General Catalog on the Applications of Welding Engineers Compounding-Extracting-Extruding Equipment.

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I.C.I. PLASTICS

Serve the Aircraft Industry

Photo. by courtesy of the De Havilland Aircraft Co. Ltd.

There are few British aircraft in which I.C.I. plastics are not used somewhere, whether it be in the manufacture of radomes for night fighters, or p.v.c. fabric for the interior decoration of new airliners.
I.C.I. Plastics have contributed much to the success of the De Havilland Comet—the world's first jet airliner.

'Nuron', 'Perspex', 'Alkathene', 'Welvic', and 'Fluon' are Registered trade marks in the United Kingdom, the property of Imperial Chemical Industries Limited.

The plastics widely used in this aircraft are:

'NURON'—low pressure contact laminating resin used with glass cloth in the fabrication of large and small ventilation pipes, fume ducts, wing tips, fan casings, etc.

Advantages: simple and inexpensive fabrication, low weight of mouldings, toughness.

'PERSPEX'—acrylic sheet for pressurised cabin windows (including inner framing), lighting fittings, toilet fitments, accessories, etc.

Advantages: ease of fabrication, low weight, toughness, excellent weathering properties.

'ALKATHENE'—brand of polyethylene for radar cable insulation.

Advantages: low power factor, lightness in weight, ease of extrusion.

'WELVIC'—polyvinyl chloride for electric cable insulation.

Advantages: ease of extrusion, resistance to abrasion, available in non-inflammable grades, made in a wide range of colours for easy cable identification.

'FLUON'—polytetrafluoroethylene, a special high-frequency dielectric.

Advantages: unaffected by high temperature or corrosive fluids.

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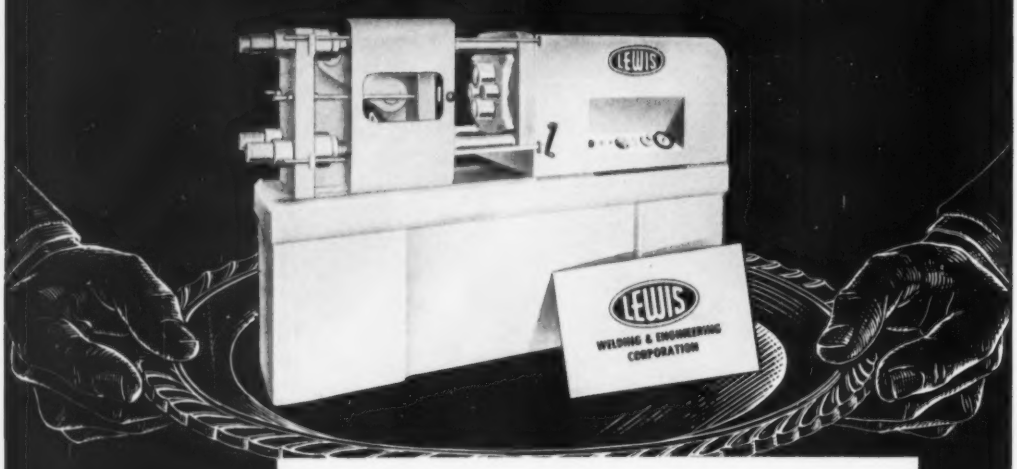
P.5238

Production on a Platter



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You could pay more and still not get half the features this versatile machine offers . . . fully automatic operation . . . multiple shot injection . . . full-mold high-pressure injection at low plunger pressures . . . fast opening crank-operated die-lock mechanism that clears jammed nozzles in 20 seconds or less. In addition, the **LEWIS "4"** handles almost any molding material . . . takes only 16 square feet of floor space . . . requires least maintenance of any machine available today.

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Emery Monomeric plasticizers are noted for their low temperature properties . . . . . their stability to light and heat . . . . and their outstanding resistance to oxidation and rancidity. Practically water-white . . . they have low pour points, low specific gravities and low volatilities.

The Polymeric types are special polyesters that are designed to supply permanence and durability. Although Polymeric in nature, they are sufficiently fluid at normal temperatures to be handled in bulk with ordinary equipment.

Check these Plastolein Plasticizers for those applicable to your Operation—

PLASTOLEIN 9050 DHZ

(di-2-ethylbutyl azelate)—a highly-efficient specialty plasticizer for high clarity films, coated fabrics, extrusion compounds and other elastomers where low-temperature flexibility is essential. Excellent for non-thickening dispersions.

PLASTOLEIN 9058 DOZ

(di-2-ethylhexyl azelate)—a good all around basic plasticizer that also imparts excellent low temperature properties. Its outstanding combination of properties leads to its use in any vinyl product. Also advantageous for nitrile and GRS rubbers.

PLASTOLEIN 9055 DGP

(diethylene glycol dipelargonate)—a general purpose auxiliary plasticizer for imparting low-temperature flexibility, excellent "hand" and drape to vinyls. Also, an outstanding low-temperature plasticizer for Neoprene and Buna-N rubbers.

PLASTOLEIN 9250 THFO

(tetrahydrofurfuryl oleate)—a fatty type plasticizer of unusual stability, providing internal lubrication for superior processing. Also imparts excellent "hand" and drape to films and sheeting. Its relatively low cost makes it attractive for cellulosics, particularly nitrocellulose, and synthetic rubbers.

PLASTOLEIN 9715, 9720 POLYMERIC

These Polymeric Plasticizers impart extreme durability and weatherability to plastic materials, yet exhibit the low-temperature characteristics and high efficiency of most monomeric plasticizers. They are compatible with the vinyls, cellulosics and synthetic rubbers. Prolonged exposure to heat and ultraviolet light does not result in appreciable discoloration, stiffening, or sweat-out.

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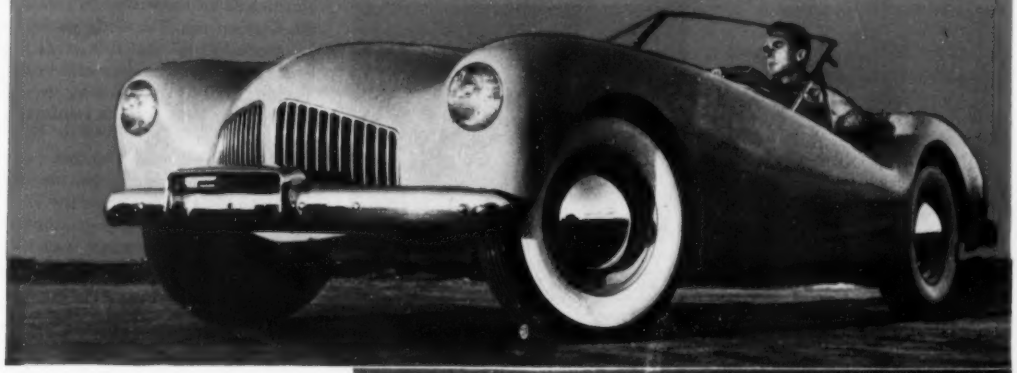
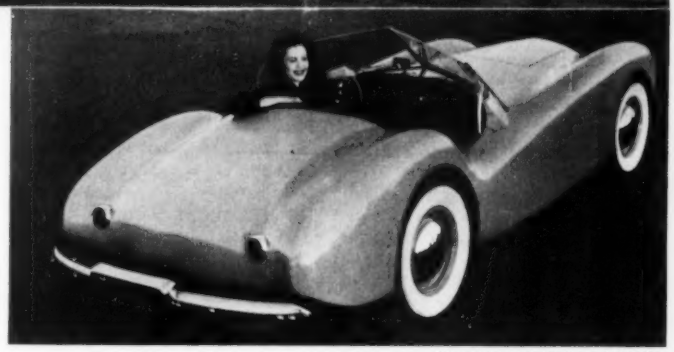
MODERN PLASTICS

FEBRUARY 1953 VOL. 30, NO. 6

Reinforced Plastics Automobile Bodies

"Watch 1953. Plastics bodies are not only the coming thing—they have come and they are too good not to stay"





Photos courtesy United States Rubber Co.

Front and rear views of Glasspar reinforced plastics body show its sleek lines

ZOOMING popularity of the sports car, both in this country and abroad, is opening up a fabulous new market for fibrous glass-polyester laminates in automobile bodies. With individual body builders now actively producing fibrous glass bodies in ever-increasing volume and with several of the major auto manufacturers turning to this material for sports car prototypes for market evaluation, the reinforced plastics auto body is moving off the drawing board, out of the dream stage, and into actual, if limited, commercial production.

Reinforced plastics bodies for automobiles are not a brand new idea. As far back as 1936, Henry Ford swung a sledge hammer harmlessly against an experimental plastic body panel made by his own company, demonstrating the possible use of plastics in this field. Since that time, a number of reinforced plastics auto bodies have been built —usually on an individual or "laboratory" basis. Through the development of improved polyester and epoxy resins, supplemented by better and more versatile forms of glass fiber reinforcing materials, development work along these lines has been greatly accelerated during the past two or three years.

Even prior to World War II, research work on laminated plastics auto bodies in Germany was assigned high priority by Nazi authorities. Their essential goal was a small car having a double-wall type body utilizing plastics bonded sheets of paper and fabric. These efforts were terminated by the war, but it is apparent that German manufacturers have by no means lost interest in the subject; it is re-

Courtesy Motor Trend

Lancer, which appeared in 1951, was first of several bodies made from the same mold

Courtesy Viking-Craft

Skorpion car body has typical strength and light weight properties of reinforced plastics

ported that car manufacturers in East Germany turned out 2000 plastics-bodied autos during 1952.

In the U. S., no one individual can claim full credit for developing the reinforced plastics auto body. William B. Stout, whose rear-engined Scarab car was built in the 40's, was one of the pioneers in demonstrating the possibilities of reinforced plastics body construction. His car, an enclosed type with such advance features as movable "lounge" type seats, was literally plastics from end to end, even including the bumpers.

In 1951

More recently, the work of Glaspar Co., Santa Ana, Calif., headed by William Tritt, has been outstanding in this field. Tritt's first plastics-bodied car—the Boxer—was one of four autos with reinforced plastics bodies shown at the 1951 Motorama in California. The second Glaspar car, which was exhibited at the National Plastics Exposition, the 7th Annual SPI Reinforced Plastics Division meeting, and other shows in 1952, was illustrated and described in the April, 1952, issue of MODERN PLASTICS. Glaspar's work with sports car bodies grew out of its activities in building the Henry J chassis. Howard Darrin, prominent auto designer who styled the Kaiser automobiles, is now designing several prototypes from which the ultimate Kaiser sports car will be selected. One of these preliminary cars is a sleekly styled job standing only 34 in. high and having such features as a convertible top which retracts into the trunk compartment and doors that slide open instead of swinging out on hinges—literally a Godsend in a closely packed parking lot.

K-F Production Car

Kaiser-Frazer spokesmen point out that this car is not the production version of the new K-F sports car, which will be officially unveiled at the Chicago Auto Show in March. According to K-F, the final design will differ in many respects. Production plans for this new sports car, details of the molding procedure to be followed, etc., have not yet been announced. Its reported price will be approximately $2000.

Muntz Car Co., Inc., Evanston, Ill., is also planning to place a reinforced plastics sports car body in production early in 1953. This will be used for the company's low-slung Muntz Jet sports model, which is currently supplied with a custom-made sheet steel body and retails at approximately $5500. Contrary to the one-piece construction used on most fibrous glass bodies, the Muntz body will have individually molded fenders, hood, rear deck, and doors, which will be assembled to produce the finished car. The body parts, to be produced in the East, will be molded in matched metal dies, marking the first production use of this type of tooling for a reinforced plastics auto body.

Muntz spokesmen state that with the interchangeable molded plastics parts, the high labor costs involved in hand production of the present metal body components can be greatly reduced, thereby lowering the price of the car as much as $800. They also point out that by using individual sections rather than a one-piece body construction, the task of repairing a badly damaged body will be greatly simplified. More details concerning the Muntz reinforced plastics body, production schedules, etc., are expected to be available within the next few weeks.

Plenty of Activity

Although at the current writing, K-F and Muntz are the only major manufacturers who have announced their intention of producing cars with reinforced plastics bodies, there is plenty of activity along this line by various individuals and smaller organizations. Much of this work centers on the West Coast, where the mild year-round climate and emphasis on outdoor living stimulates wide interest in sports cars. A number of individuals and companies are now active in the production of reinforced plastics car bodies.

Vale Wright, Berkeley, Calif., artist and designer, has created an attractive fibrous glass body designed to fit the chassis of the popular MG sports car. Design features include a curved windshield, fender skirts,

and knife-edge rear fender fins. Wright's plans call for turning out about one complete body per day, to be mounted on the standard MG chassis by the purchaser. The unit sells for approximately $700. Eric Irwin, Costa Mesa, Calif., whose original Lancer was one of the four fibrous glass cars shown at the 1951 Motorama, has built several others from the same mold and is now working on a modified body which will fit any chassis with a wheelbase from 100 to 110 inches.

Another plastics pioneer from the West Coast was the Skorpion, a small car brought out by John A. Wills and Ralph Roberts, who formed the Wilro Co. First exhibited at the 1951 Motorama, the Skorpion was designed for use on a Crosley chassis. By March, 1952, about 20 Skorpion body kits had been delivered to buyers.

For Standard Chassis

In May, 1952, rights to this body were acquired by Doug Caruthers of Viking-Craft, Anaheim, Calif. The company is now producing two fibrous glass bodies, including the standard unit which fits the 1947-51 Crosley pickup, station wagon, and sedan chassis, and the new Super Skorpion, designed to be used on the Super-Sports Crosley, Renault, Morris, and other small chassis. A V-type windshield, separate trunk opening, fibrous glass dash panel and light weight—less than 150 lb.—are among features of the Super Skorpion, which sells for $640 as compared to $460 for the standard type body. A new body style known as the Cheetah, which will fit a modified Ford chassis, is scheduled to make its appearance early in 1953.

Roy Kinch and Mickey Thompson, Jr., Alhambra, Calif., operating under the firm name of Atlas Fiber-Glass, Inc., are going into production on a coupe type body for the MG chassis, which is available complete with lights, instrument panel, windows, and one or two doors at $685. They also plan to produce a roadster body for the same car. An unusual feature of the Atlas body, which weighs less than 200 lb., is the fact that it is rigidly reinforced throughout with ½-in. steel tubing. At Mountain View, Calif., Maverick Motors has built what is reportedly the largest reinforced plastics body yet constructed—a 220-lb. one-piece unit designed to fit cars having a wheelbase from 123 to 125 inches.

The record-smashing City of Burbank streamliner, built by George Hill and Bill Davis, which last September turned in an official international record of approximately 230 m.p.h. across the Bonneville salt flats, also features a laminated plastics body. The car is powered with two Mercury engines. Ted Thal of Thalco, West Coast distributor for Owens-Corning Fiberglas, Inc., supplied the fibrous glass, polyester resins, and other materials used in constructing the body of this racer, which was built by the Thalco process. The body shell was laid up and cured directly on a full-sized plaster mock-up, using resins which cure through the action of ultra-violet rays when exposed to direct sunlight. Thalco specializes in supplying materials for car bodies and other fibrous glass polyester products, and has prepared complete directions which are made available to builders. One of their products is a small kit, priced at $10, with which the prospective body builder can construct a scale model of his car in advance to learn the techniques of working with fibrous glass laminates.

In Detroit

What about the Motor City? Detroit's latest contribution to the reinforced plastics sports car body field is the La Saetta (Bolt of Lightning), developed by Gino and Cesare Testaguzza, long affiliated with the automotive industry. La Saetta, having a 112-in. wheel base, is made in one piece, including front bumper, using glass cloth as well as

Three views of experimental reinforced plastics car body projected by Kaiser-Frazer Corp. as part of its sports car program. Car doors slide open instead of swinging on hinges

Courtesy Darrin Automotive Architects

Photos courtesy Motor Trend

glass mat as the resin reinforcement.

Says Gino Testaguzza: "Realizing the growing interest in sports cars and also the prohibitive cost, making it impossible for most lovers of such cars to own one, we came upon the idea of making a body which could be adapted to the chassis of several American made cars, so the sports car enthusiast can have an attractive car on his old chassis."

The original La Saetta body, mounted on a Chevrolet chassis, weighs only 175 lb. and will fit any wheelbase between 110 and 116 in., the only change required being in the width of the doors. Minus decorative trim, this body is expected to sell for less than $1000. Testaguzza Bros. & Co., Inc., is now building a plant at Oxford, Mich., expected to go into operation early in 1953. Projected output is five bodies daily. Now in the sketch stage is a somewhat smaller reinforced plastics body to compete with regular sports cars.

Four-Part Body

Rockefeller Sports Car Corp., 618-B Sunrise Highway, Rockville Center, New York, is putting the finishing touches on its first four-passenger sports car body. The body, molded by Lunn Laminates, Huntington Station, New York, is made in four parts; front and rear sections and two doors, each of which has its separate mold. A full-scale plaster mock-up was produced from the original design of Warren Shiber, president of Rockfeller Sports Car Corp. This mock-up was delivered to Lunn Laminates which, in turn, pulled four polyester-glass masters from the plaster. Layups of glass mat and polyester resin were then made in each mold and a flexible bag, vacuum molding job ensued. The body sections are approximately 3/16 in. thick and are now being mounted on a modified Ford V-8 chassis. Complete with specially designed upholstery made from Naugahide, these four-passenger sports cars are scheduled to sell in the $2000 price range. Sponsored by Naugatuck Chemical Div., U. S. Rubber, this car is scheduled to be on display in the lobby of the Shoreham Hotel, Washington, D. C., at the Eighth Annual Convention of the Reinforced Plastics Section of the Society of the Plastics Industry.

Body: $650

At Toledo, Ray Greene Co., producers of fibrous glass boats for the past five years, plans to make a sports car body of unusual design, built to fit any chassis of 100-in. wheel base. A cushioned dash panel, foam rubber seats, and canvas or Orlon top are among features of a complete sports car, the Frazen, available with this body. This car, having a Henry J chassis and a six-cylinder engine, sells for for $2795 FOB Toledo; the body alone is priced at $650.

According to Ray Greene, the plastics bodies are produced in a plaster female mold, utilizing basically a bag molding technique. Plaskon polyester resin is employed. The experience of this company in building reinforced plastics boat hulls indicates that an excellent finish can be obtained directly out of the mold by using a gel coat or mold coat type finish in which color is incorporated. The finish, it is stated, tends to improve with polishing.

The Ray Greene body is designed so that it can be mounted on any standard American motor car chassis with less than three man-hours of labor. This includes lowering the steering wheel and chassis; it is not necessary to shift the engine location or incorporate a universal joint in the steering gear.

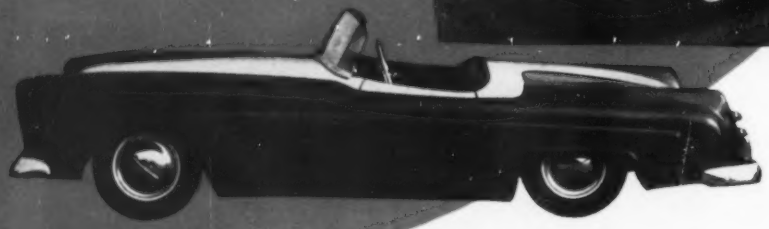
Greene estimates that with present facilities, most of which are now devoted to boat production, the company could step up its output to four car bodies daily within 30 days and 20 per day within 60 days. Actual time in and out of the mold, including the layup, runs approximately three hours. Heat for curing the resin is supplied by strip heaters.

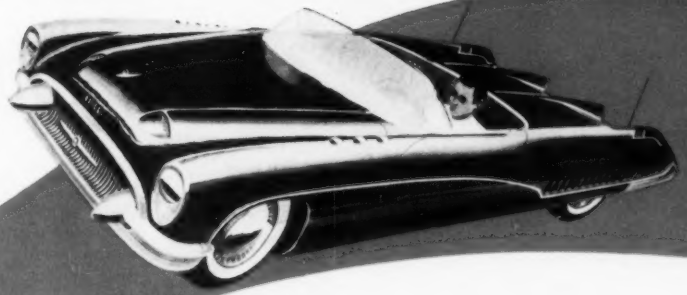
Keen Competition

Although all the major automotive manufacturers are known to be studying fibrous glass laminates closely, for a variety of applications

Courtesy Testaguzza Bros. & Co., Inc.

La Saetta reinforced plastics body is designed to fit several standard U. S.-made car chassis
Courtesy Motor Trend





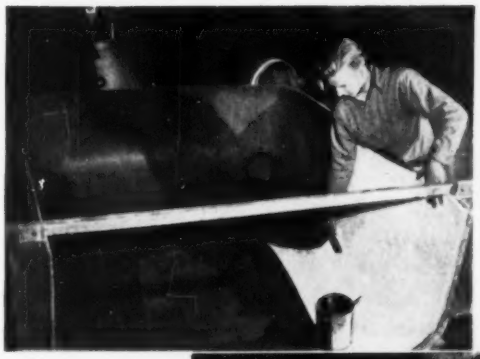
New Buick Wildcat will be exhibited to test public reaction to use of a reinforced plastics body

Courtesy Buick Motors Div., General Motors Corp.

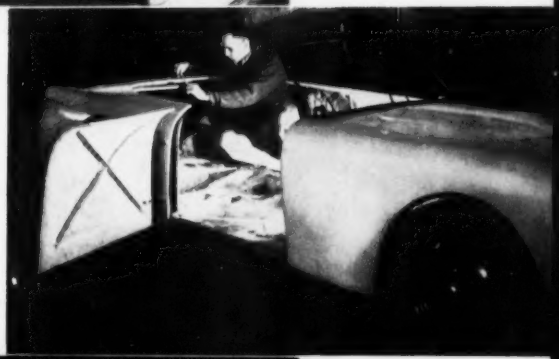
ranging from low cost metal-forming tools and fixtures to complete car bodies and important body components, official statements are scarce because of the keen competitive situation prevailing in the motor industry. It is believed, for example, that one of the "big three" manufacturers will unveil several plastics-bodied prototype sports cars at a showing in New York City late in January. Presumably, these cars will be exhibited to sample public reaction to their design and, possibly, the use of fibrous glass laminates in body construction.

One car definitely slated to be shown at that time is the new streamlined Buick Wildcat, which was still in the construction stage when this issue went to press. Ivan L. Wiles, general manager of Buick Motor Div. and vice president of General Motors Corp., announced that the Wildcat was designed to test the possibility of using fibrous glass for bodies which would be much lighter than those of conventional construction. "The use of glass," stated Mr. Wiles, "could lead to greater flexibility in styling since the unit tooling cost in low volume quantities would probably be considerably less than otherwise possible under present conditions. For that reason, glass has some very good possibilities for building special models designed for limited production."

The big manufacturers are still evaluating reinforced plastics to see where these materials may be most



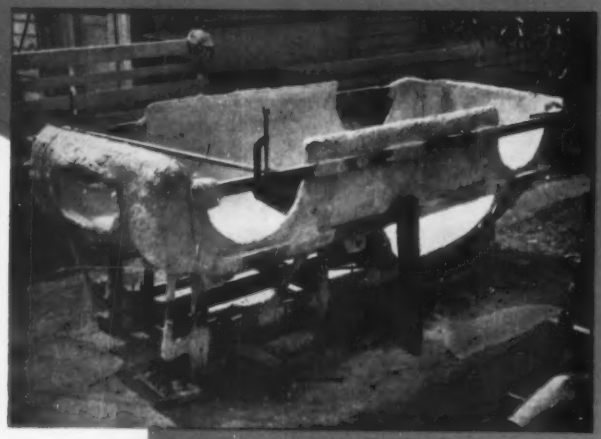
Layup of glass mat is impregnated with resin in mold for front section of Rockefeller body



Four separately molded sections—front, back, and doors—are assembled on chassis and finished

Photos courtesy Lunn Laminates, Inc.

Completed Rockefeller car is designed with hinged hood section to give access to the engine



Photos both pages courtesy Atlas Fiber-Glass, Inc.

Female mold for Atlas MG coupe type reinforced plastics body

After removal from mold Atlas body undergoes finishing operations

Coupe body weighs 185 lb. stripped, about 300 lb. with equipment added

advantageously fitted into their own production requirements. While recognizing the light weight of these materials, low cost tooling, impact resistance, freedom from rust and corrosion, sound deadening characteristics, design flexibility, and other "plus" attributes, they also see in reinforced plastics a material which cannot readily be fabricated with their present equipment and methods.

Considering the enormous capital investment now wrapped up in metal forming dies, punch presses, and other metal fabricating equipment, motor car manufacturers cannot be expected to make a wholesale changeover to new materials and techniques with which they are not yet fully familiar. However, sports cars, station wagons, and other limited production body types, for which it is difficult to justify costly tooling, offer an excellent opportunity for automotive producers to test reinforced plastics bodies in actual production.

New Market

The rapidly growing popularity of sports cars in the U. S., with sales reportedly now at the rate of around 30,000 units per year (most of which are imported), presents a new market challenge which domestic manufacturers can hardly afford to ignore. More and more consumers, chagrined at the cost of buying and operating today's larger, more expensive cars, are looking for a smaller, sports-type car which is reasonable in first cost, light in weight, easy to handle in heavy traffic, and economical to operate. Such a car must be of rugged con-

struction, to keep maintenance at a minimum, and above all, safe. Fibrous glass body construction is ideally suited to all these requirements.

Some automotive spokesmen point out that, regardless of its many superior features, the reinforced plastics body has certain economic and manufacturing limitations. The basic material, for example, currently costs about ten times as much as sheet steel. A Chevrolet research and development spokesman was recently quoted as saying: "Costs are against glass cars at the present." Industry representatives declare that two of the biggest obstacles are the cost factor and the relatively slow production cycle, as compared with bodies using large sheet steel stampings.

As far as the production cycle is concerned, the outlook is by no means pessimistic. The statement by one automotive engineer that four steel hoods can be stamped out in one minute, while a single reinforced plastics hood requires some three minutes to be formed in a press, fails to take account of the subsequent finishing operations still required on the metal hood stamping.

A top styling department executive for one of the major manufacturers calls attention to the fact that complete body sections, such as the floor of the car, might be molded in one piece with integral reinforcing members, eliminating the multiplicity of welding operations, fixtures, and operators now required with metal construction, as well as the huge power requirements of the welding equipment.

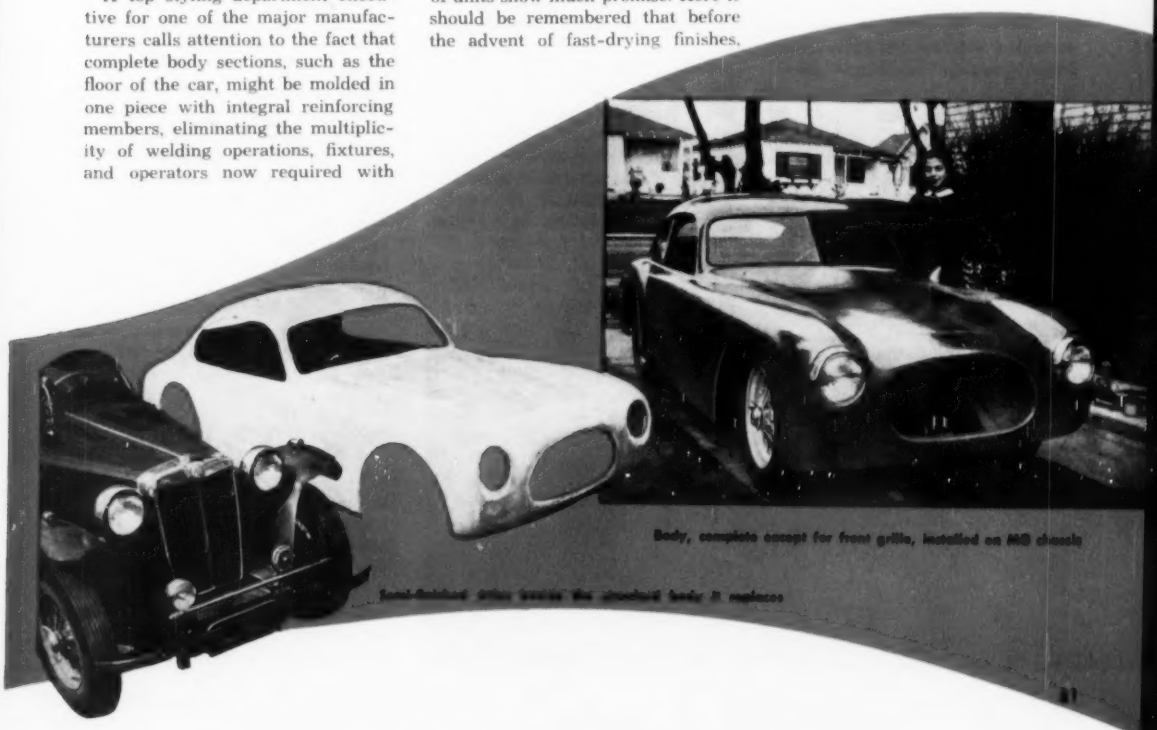
The vast improvement in working conditions on the production line, elimination of intricate sub-assemblies and inherently rust-proof nature of the plastics body are some of the points which must be borne in mind in evaluating fibrous glass laminates as a body construction material. Absence of metal-to-metal contacts should go far toward eliminating bothersome squeaks and rattles.

Augmenting the lower cost of dies and capital equipment, and the fact that large units may be built in one piece without costly, time-consuming assembly operations, is the fact that finishing operations may be reduced to a minimum with fibrous glass bodies. The successful use of "gel coat" finishes with integral color on boat hulls, bathtubs, and other large reinforced plastics products leaves little doubt that similar techniques may be widely employed on complete auto bodies. This type of work still requires further development, but finishes which have already been accomplished on refrigerator components and other types of units show much promise. Here it should be remembered that before the advent of fast-drying finishes, motor car manufacturers required literally acres of space in which to apply and dry multiple coats of paint to auto bodies, with the total operation extending through several days.

Rapid Tooling

Dynamic Detroit, accustomed to thinking in terms of months when retooling for new models, is intrigued by the low cost and speed of tooling up for reinforced plastics. The facility with which molds may be created for plastics bodies or body sections would enable manufacturers to restyle certain models at more frequent intervals, thereby giving the sales department a powerful new merchandising weapon. Under the present high cost of tooling for sheet steel bodies, the cost of bringing out a really new body design at less than two or three year intervals is prohibitive. As a result, cars produced during interim years are customarily "face-lifted" with minor alterations in front grilles, parking lights, or other minor details.

Although Ford Motor Co. is mum concerning possible plans to bring out a reinforced plastics prototype



Body, complete except for front grille, installed on MG chassis

Sand-finished grille awaits the standard body it replaces

Photos courtesy Ray Greene Co.

Frozen sports car body is designed to be mounted on a number of different car chassis with less than three man-hours of labor

or actual production model, this company has found materials of this type extremely useful in its styling division in the preparation of models for appearance evaluation prior to actual production. Ford also uses reinforced plastics, along with thermoplastic sheet materials and casting resins, in working out design and manufacturing problems which would take infinitely longer if this operation were based entirely on blueprints and metal parts from completed dies. According to Wallace A. Stanley of the Ford Manufacturing Engineering Staff, "one plastic model is worth 40 pounds of blueprints and 40 hours of exlaining."

In the styling department, Ford's previous practice was to take the original clay mock-ups of new models and try to preserve them for study and examination by sales officials. To simulate chrome plated parts, such as bumpers, trim, and door handles, aluminum foil was painstakingly applied to these areas, but even with skilled craftsmanship the results left much to be desired. Furthermore, the clay models were fragile and difficult to preserve.

Working with fibrous glass and polyester resins, and using a simple room temperature cure, Ford is now able to duplicate the contours of clay or plaster prototypes quickly at low cost. Through this method, a lightweight body shell may be quickly created which can be easily moved around without damage and finished so attractively that even an expert can scarcely distinguish it from an actual car, just off the production line. Chrome plating may be applied directly to reinforced plastics bumpers, door handles, etc., faithfully duplicating the most intricate design details.

Possibilities

In attempting to predict the future role of reinforced plastics in auto body construction, it is well to bear in mind the work already being done with these materials in the production of contour-styled furniture, trailer bathtubs, office equipment, housings, lamp shades, and other items. All such products tend to familiarize the public with the desirable characteristics of reinforced plastics and will facilitate their acceptance in motor car bodies. Consider the parallel between a fibrous glass lamp shade and a translucent top of the same material, which would allow softly diffused light to reach the car interior while shutting out heat, cold, and moisture. One experimental top being studied in Detroit weighs only 27½ lb. as compared to 50 lb. for a steel top of the same size. By tinting the resin, the top could be made in any desired color. Rugged corner caps for trailer bodies, already in production, indicate other possibilities in this direction.

Pre-mix type materials, incorporating glass or other types of reinforcing agents in a putty-like compound which may be compression molded into structures having excellent finish and phenomenal impact strength, may also play an important role in this entire development. Now in actual use on three body models of the 1953 Dodge Coronet are heater intake ducts molded of a special type pre-mix incorporating sisal as a filler agent, in combination with American Cyanamid polyester resin. The ducts, having an intricate contour, are molded in two parts which are riveted together. These ducts minimize heat radiation due to the insulating characteristics of the material. Another automotive part of undisclosed identity, which will be made of the same type material, is to be approximately 5 by 2 ft. in size.

Skorpion reinforced plastics car bodies were pioneered on the West Coast

Courtesy Viking-Craft

Here to Stay

Has the reinforced plastics auto body arrived? James E. Potter, managing editor of *Motor Trend*, in an article on sports car bodies in the magazine's December issue, summarized the situation neatly in these words:

"Watch 1953. Plastics bodies are not only the coming thing—they have come, and they are too good not to stay."

S.P.I. Session on Reinforced Plastics

PROGRAM for the Eighth Annual Technical Session and Exhibit of the S.P.I. Reinforced Plastics Division, to be held at the Shoreham Hotel, Washington. D. C., February 18 through 20, complete as of the time of going to press, will be as follows:

Wednesday, February 18

10:00 a.m.—Session

Presiding: I. M. Scott, Winner Manufacturing Co.

Recording Secretary: Billy B. Curl. Russell Reinforced Plastics Corp.

"S.P.I. Reinforced Standards Report." Arthur L. Smith, Rohm & Haas Co.

"Why Reinforced Plastics?", L. S. Meyer, Western Products, Inc.

"An Evaluation of Several Classes of Fillers for Reinforced Plastics," Louis Linzmeyer, East Coast Aeronautics, Inc.

"Releasing Parts from Molds," James Lunn and Robert Barnett, Lunn Laminates, Inc.

"Finishes for and Surface Qualities of Glass Fiber Reinforced Moldings." Byron W. Nelson and Charles W. Munton, The National Cash Register Co.

"Glass Reinforced Polyester Molding Compounds and Molding Processes." Dr. Albert G. H. Dietz, M.I.T.

"Use of Polyester Resin Preimpregnated Glass Cloth in Mated Die and Vacuum Bag Molding," H. J. Friedman, Russell Reinforced Plastics Corp.

12:30 p.m.—Luncheon

Presiding: Hiram McCann, Editor, MODERN PLASTICS Magazine.

Recording Secretary: Lawrence Wittman, Cordo Molding Products, Inc.

Case Histories of Successful Products, a panel discussion with molders and customers.

1. Job—Parts for accounting machine; molder, R. S. Morrison, Pres., Molded Resin Fiber Co.; customer, Byron W. Nelson, Head of Plastics Div., National Cash Register Co.

2. Job—Chair designed by Charles Eames; molder, Milton Brucker, Pres., Zenith Plastics Co.; customer, J. M. Eppinger, Herman Miller Furniture Co.

3. Job—Reinforced plastics refrigerator liner; molder, Charles D. Jones, Pres., Structurlite Plastics Corp.; customer, O. E. Norberg, Director, Appliance Engineering, Crosley Div., Avco Mfg. Co.

4. Job—Complete line of reinforced plastics luggage; molder, Edwin F. Bushman, Plastics Div., General American Transportation Corp.; customer, John Brier and John Belber, Belber Trunk & Luggage Co.

5. Job—Electrical insulating components; molder, Roger B. White, Pres., The Glastic Corp., Inc.; customer, Charles Yarrick, Asst. Design Engineer, ITE Circuit Breaker Co.

6. Job—Mass-produced reinforced plastics automobile body; molder, to be named later; customer, George C. Harbert, Chief Engineer, Automotive Div., Kaiser-Frazer.

3:00 p.m.—Contact Period

Molders and fabricators to remain in individual rooms.

6:00 p.m.—Reception

Thursday, February 19

9:30 a.m.—Govt. Agency Forum

Moderator: John B. Alfers, U.S. Bureau of Ships, Navy Dept.

Recording Secretary: John A. Owen, The Sorg Paper Co.

"The Utilization of Reinforced Plastics in Transportation Equipment," K. T. Marshall, Transportation Research & Development Station, Ft. Eustis, Va.

"Air Force Use of Reinforced Plastics in Aircraft," Major W. G. Ramke, Material Laboratory, Directorate of Research, Wright Field.

"Use of Reinforced Plastics in the Coast Guard," Capt. C. E. Brush, Chief, Testing and Development Div., Coast Guard.

"Adhesives for Reinforced Plastics," H. A. Perry, Naval Ordnance Laboratory, White Oak, Md.

"Chemical Finishes for Glass Fiber Reinforcement," Dr. Porter W. Erickson, Naval Ordnance.

"Applications for Low Pressure Plastics Laminates in Naval Aircraft," Jay M. Stevens, Bureau of Aeronautics, Navy Department.

"Bureau of Ships' Activities in Reinforced Plastics," W. R. Graner, Plastics and Dielectrics Branch, Bureau of Ships, Navy Dept.

"Research and Development Board Interest in Reinforced Plastics," Robert Temple, Materials Committee, Research and Development Board.

"Reinforced Plastics in the Spot Materials Conservation Program of the Department of Defense," Franklin P. Huddle, Chief, Conservation Div., Munitions Board.

"Effects of Laminating Pressure on Properties of Glass-Fiber Laminates," John E. Wier, National Bureau of Standards.

"Works of Corps of Engineers Industry Advisory Committee on Plastics," George Howard. Research and Development Laboratories, Fort Belvoir.

"Signal Corps Applications of Low Pressure Reinforced Plastics," E. M. Beekman, Chief, Technical Advisory Staff, Material Section, Components and Materials Branch, Signal Corps Engineering Laboratory; Co-author, A. Rusch.

"Glass Base Plastics in Ordnance Applications," Gerald Reinsmith, Chief, Non-Metallic Materials Unit, Office of Chief of Ordnance.

12:30 p.m.—Luncheon

Presiding: Joseph S. Finger, Corrulux Division, Libbey-Owens-Ford Glass Co.

Recording Secretary: Charles Hoover, Owens-Corning Fiberglas Corp.

"New Developments in the Field of Resins"—A Forum.

The following representatives of resin companies will sit on this panel: Harold M. Day, American Cyanamid Co.; E. K. Stigger, Atlas Powder Co.; Frank I. Bennett, Bakelite Co.: Dr. Edward L. Kropa. The Borden Co.: Dr. Marco Wismer, Ciba Co., Inc.; Elmer Warnken, Cincinnati Testing and Research Laboratories; R. E. Dodd, Durez Plastics & Chemicals, Inc.; W. Goss, General Electric Co.; S. A. Moore, Interchemical Corp.; Irving E. Muskat, Marco Chemicals, Inc.; W. J. Smythe, Monsanto Chemical Co.;

(Continued on p. 187)

How to Select Glass Fabrics

I — Fabric Properties and How They are Obtained

by L. M. Calhoun*

The problem of selecting the fibrous glass cloth that will do the optimum reinforcing job when impregnated with resin and molded or laminated into a finished product is one of utmost importance to the reinforced plastics industry. An understanding of the ramifications of the problem can come only through an understanding of the background of first producing the fibrous glass and then weaving it into cloth. To this end, MODERN PLASTICS presents two comprehensive articles on the most significant phases of the subject. The first, starting on this page, covers properties of the various fabrics; the second, starting on p. 86, covers properties of the finished moldings.—*The Editor*.

THERE was a time when design engineers in end-user plastics industries included in their specifications the types of glass fabrics to be used. The trend now is for the engineers to write performance specifications only and leave it to the discretion of the reinforced plastics molders as to the type of fabrics.

The success of the individual laminators and the industry as a whole is dependent on the selection of the best material that will most economically do the job. The primary object of this article is to familiarize the molders and laminators with the details of fabric constructions so that they will be qualified to make these selections. To simplify it as much as possible, each detail that contributes to the final make-up of a fabric will be discussed.

* Textile sales engineer

Primary contributing factor to any fabric is the yarn from which it is produced, and to have a complete understanding it is necessary to have a basic knowledge of how the yarn is manufactured.

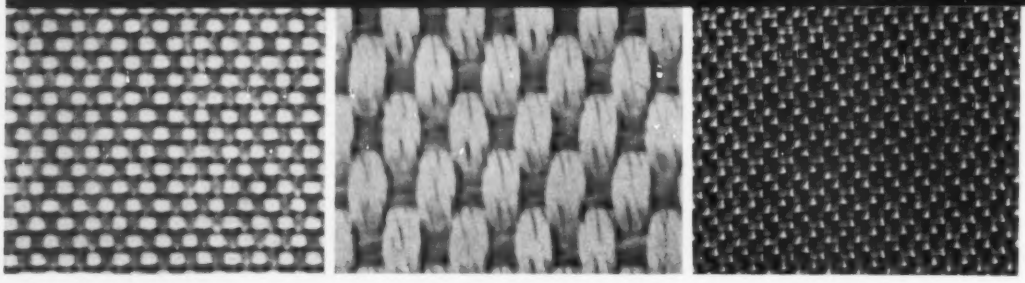
The base material for all glass is silica sand and this is also true of glass yarns. The silica, along with several other ingredients, is mixed into what is known in the industry as a batch. The batch is fed into a refractory furnace and reduced to a molten state. There are now two different ways of processing from this point. The old way, and one that is still used to a great extent, is to feed the molten glass into another tank known as a boot. At the head of this tank is a marble-producing machine which converts the molten glass into the form of small clear marbles. The new method is to feed the molten glass directly into a small platinum alloy tank known as a bushing. In the marble process, the marble is likewise fed into the bushing where it is melted.

The yarns may be produced in two different forms: 1) continuous filament and 2) staple.

Continuous filament yarns — The bushings have very small orifices in the bottom, usually 204 in each bushing. These bushings are located on a mezzanine floor; directly underneath them are the winders. The bushings are maintained at a temperature which will keep the glass in a molten state. The glass is then drawn through these small orifices into fine filaments and wound on large fiber tubes by the winder on the lower level. The number of filaments, of course, is determined by the number of orifices in the bushings.

To lubricate the individual filaments so as to prevent them from abrading each other in subsequent processes, a sizing material known as a binder is applied between the bushing and the winding operation. This application of sizing operation should be noted with special interest because, although it is necessary to facilitate further processing, it also causes a lot of trouble to the laminator. This will be elaborated

Most Common Types of



Plain weave | Basket weave | Crowfoot weave

for Plastics Reinforcement

on in more detail when discussing the various finishes. The winding process draws the individual filaments together, this group of untwisted filaments being called a sliver.

It is not practical for a weaver to produce a fabric from a mass of untwisted filaments and so at this point it is necessary to twist the filaments together. This operation is performed on equipment generally called a twister. After twisting, the sliver becomes a strand of yarn. Very few fabrics are woven from single strand yarns but are generally produced from multiple strands known as plied yarn. This, of course, requires another operation called plying, which is performed on a machine similar to the twister. The general term used by the textile industry for twisting and plying is "throwing."

In the past, it has been customary for the yarn producer to furnish the weavers with the yarns in the twisted or plied form, but the trend now is for the weaver to do his own throwing.

Staple yarns—Staple yarns are processed the same as continuous yarns except that they are not drawn from the bushings by a winding operation. In this process, a jacket is built around the tips of the orifices in the bushings; by the action of steam or compressed air, the glass is forced from the bushings and blown down to a perforated revolving drum. The drum catches the mass of fibers by means of suction and permits them to be drawn off by a winding attachment in the form of an untwisted rope also known as a sliver. Again, a binder or sizing is applied. These yarns must also be twisted and plied. Staple glass yarns may be compared to cotton or wood whereas the continuous yarns are comparable to filament rayon, nylon, etc.

After the yarn has been prepared, the weaver must process it through numerous operations before putting it on the loom for weaving.

Yarn Sizes and Constructions

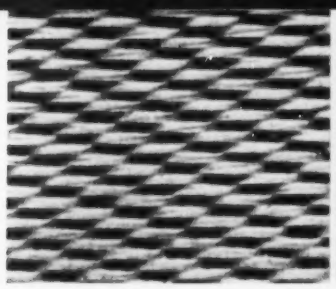
Continuous yarns—Since the bushings are generally made up with 204 orifices, the single strands of yarns have 204 filaments. To change the size of the base yarns, the diameter of the orifices are varied, which consequently changes the diameter of the individual filaments. The weight of the yarn also varies with the filament diameters. Today, the three commonly used filament sizes are: 1) "D"—0.00023 in. diameter; 2) "E"—0.00028 in. diameter; and 3) "G"—0.00038 in. diameter. There is a fourth size, "K"—0.00053 in. diameter, which is now being evaluated.

The above terms designate individual filament sizes and, as previously explained, 204 filaments make up a single strand of yarn. The yarn sizes are expressed in the number of yards that it takes to weigh one pound. "D" yarns are generally expressed as 450's, "E" yarns as 225's,

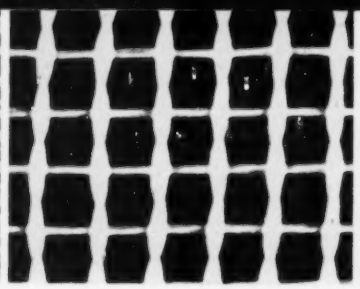
Courtesy Owens-Corning Fiberglas Corp.

Glass filaments are produced on upper level, then wound on fiber tubes below

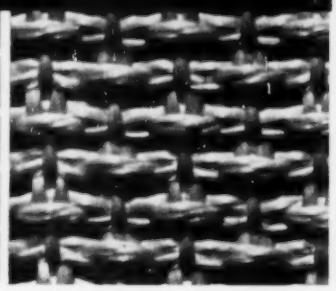
Weaves of Glass Fabrics



Harness satin weave



True leno weave



Mock leno weave

and "G"yarns as 150's. The fourth one, "K" yarns, 75's, is under evaluation.

The 450's indicate that it takes 45,000 yards to weigh a pound; the 225's take 22,500 yards to weigh one pound, etc. In other words, the yarn number multiplied by 100 equals the number of yards it takes to weigh one pound. For an example and to summarize the preceding, 45,000 yards of 204 "D" filaments weigh one pound.

There are two exceptions not indicated above; there is a 900's yarn which is produced from the "D" fiber by using only 102 filaments and there is a 450's yarn produced by using only 102 filaments of "E" fiber. For this reason, it is necessary to specify both the filament and the yarn size.

As previously mentioned, very few fabrics are produced from single yarns but are woven from the plied yarns. For example, the standard 164 cloth is woven from 225-4/3 yarn. This indicates a plied yarn and that on the first operation four strands of 225's yarn are twisted together. On the second operation, three ends of the twisted yarns are plied together, resulting in a 12-ply yarn. For all practical purposes to compute the weight of the plied yarn, it is only necessary to divide 22,500 by 12, which gives the yards per pound. For accuracy, it is necessary for the weaver to allow for contraction due to twist. So as to get a balanced yarn, the yarn is usually twisted in one direction and plied in the opposite direction. A twist in the yarn is expressed in the number of turns per inch, (T.P.I.). For laminating purposes, it is best to hold the twist at a minimum so as to permit better penetration of the resin. This also produces a flat yarn which is generally more desirable.

Staple yarns—Staple yarns in the past have been limited to one size of fiber diameter, namely "G" fiber. The numbering system for staple yarns is the same in that the yarn number indicates the number of yards it takes to weigh one pound. The staple yarns are generally much heavier than the filament yarns and are usu-

(*Continued on p. 189*)

II—Properties of the Finished Moldings

by R. F. Clark* and C. F. Dangelmajer**

IT IS not surprising that molders of reinforced plastics frequently become bewildered when attempting to choose the proper glass fabric for a particular job.

The confusion begins with the fact that 20 to 30 different constructions are being offered by the weaving trade—and the same fabric construction is being sold under as many as seven different names. Further confusion is caused by the fact that a fabric having the same construction, similar weight, thickness, and substantially the same properties, can be made from four different basic yarns. (See Table 1.)

Weavers are called upon to explain the differences and similarities to their plastics reinforcement customers, and find this rather difficult at times. This is because results with the various fabrics depend on the laminator, the resins used, the finish, the technique, the equipment, and even the weather.

To understand the situation one must know a little of the history of glass fabrics.

In the very early days of glass textiles, only two continuous filament types of glass yarns were made. Both of these were made of the same size (0.00023 in.) filament. The finer yarns, known as 900's, started with a single strand made up of 102 filaments; the larger yarns, 450's, were made up of 204 filaments. These strands were twisted and plied together to make up whatever sizes finished yarns were desired for the particular project.

The theory at this time was to produce the thinnest, and thus the strongest and most flexible, commercially practical filament.

Overlapping of Products

Starting at this point, the first market to be developed for glass fabrics was in electrical equipment. Almost all of the glass cloths developed up to 1943 had been constructed with an electrical end use in mind and for use with high pressure resins. Even then there was overlapping of products available, primarily due to the newness of the industry. This resulted in several fabrics being made and eventually written into specifications which, for all practical purposes, were identical with each other. This situation still exists, and has carried over into the development of reinforcement fabrics for polyester and other low-pressure resins.

* Vice-president; Hess, Goldsmith and Co., Inc.
** Industrial Products Div.; Hess, Goldsmith and Co., Inc.

Table I—Similar Glass Fabrics From Four Different Yarns

Fiber diam.	Yarn use, warp and filling	Oz./Yd.	Thickness (in.)	Ends/inch Warp	Ends/inch Fill	Min. avg. break strength, #/in. Fill	Min. avg. break strength, #/in. Warp	Approx. cost per yd. (38 in. Width)
D. 127	450 3/2	6.00	0.007	42	32	250	200	.88
E. 128	225 1/3	6.00	0.007	42	32	250	200	.73
G. HG-28	150 1/2	6.00	0.0067	42	32	250	200	.71
K. HG-2875	75 1/0	5.40	0.0075	42	32	200	160	.385

Table III—Strength Characteristics of Some Glass Reinforced Plastics

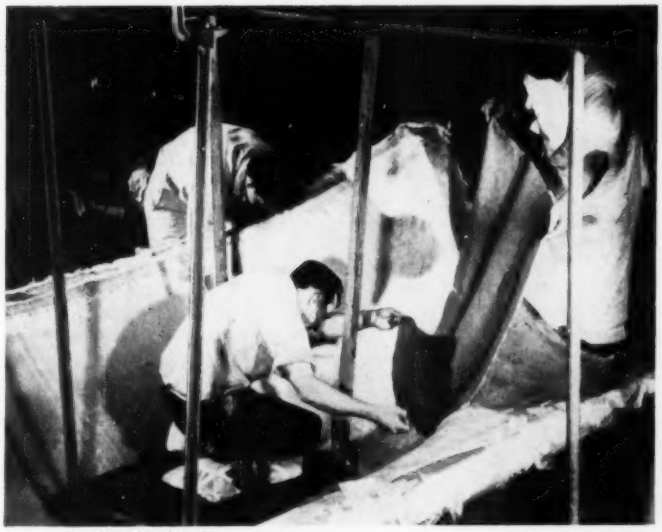
Laminate identity	*162*[a]	*181*[a]	*(Polyester)*[c] *M-503*[b]	*(Polyester)*[c] *M-503*[c]	*Phenolic cotton fabric*[d]
Tensile, p.s.i.	41,600	45,900	17,380	24,000	5,500
Flexural, p.s.i.	34,100	67,400	27,300	40,500	10,000
Flexural modulus, 10^6 p.s.i.	2.3	3.2	1.39	1.96	1.0
Compressive, p.s.i.	14,600	38,300	12,620	24,000	25,000
Resin content, %	40	38.9	57.7	43	

[a] Modern Plastics, October 1951 (American Cyanamid Co.); [b] Modern Plastics, October 1951 (Owens-Corning Fiberglas Corp.); [c] Modern Plastics, October 1951 (Naval Air Material Center, Aero Material Lab. Report #AML); [d] Paper presented at S. P. I. meeting March 1, 1951, by Dr. J. A. Loritsch, General Electric Co.; [e] Chopped strand mat by Owens-Corning Fiberglas Corp.

Thus, the first glass reinforcements for polyesters were those which had been designed for an entirely different purpose. Soon, however, a coarser, less expensive 225's glass filament was developed having a filament diameter of approximately 0.00028 inches. Fabrics using 225's yarns were then designed specifically for laminating and molding with polyesters. These were, and still are, known as 128, 164, 165, 181, 182, 183, and 184. Much development work was done with these materials. Engineering data and specifications (both government and industry) were written around these results. Most specifications were built on maximum results with reasonable safety factors. In some end uses covered by such specifications the properties obtained were far in excess of requirement. In other cases the properties fell short of requirement and projects had to be abandoned.

By about 1943 still heavier filament (0.00038 in.) was being produced and from it was made a 150's yarn. This yarn was then used mainly in braided sleeving for the electrical industry. It was thought to be much too coarse and non-flexible to be woven into cloth. However, in 1947 one weaver found that the 150's yarns could be successfully woven and that with them he could nearly duplicate all of the above fabrics which had been woven with 225's yarn.

These fabrics were presented to the reinforced plastics industry, and after thorough testing it was found that laminates made from them were as good in most respects as were their counterparts made with much more expensive fabrics. By 1949 the 150's line of glass cloth had been given



Courtesy Libbey-Owens-Ford Glass Co.

Placing glass cloth in metal mold to complete one half of an aircraft radome. Note workman suspended on platform so that he can work inside the large curved area

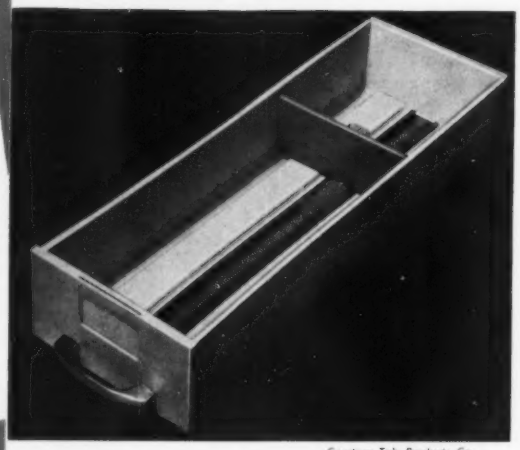
Table II—Glass Cloth Wet Strength Retention

Cloth	*Sizing*	*Resin*	*Flexural Strength Data (p.s.i. X 10^3)* *Dry*	*After 2 hr. boil*	*% dry strength retained after 2 hr. boil*
181[a]	Owens Corning 114	Laminac 4128	59.8	32.1	60
181[a]	Bjorksten	Laminac 4128	64.5	64.5	99
181[a]	Owens Corning 114	Paraplex P43	61.6	36.7	60
181[a]	Bjorksten	Paraplex P43	72.5	67.5	93
181[c]	Garan RS49	Polyester resin A	65.0	62.5	96.2
181[b]	Owens Corning 114	Polyester resin A	54.5	39.3	72
181[b]	Owens Corning 136	Polyester resin A	67.0	64.0	95
181[d]	Linde Silicone X31S	Polyester	70.0	74.0	106
181[e]	Volan	Polyester	68.0	58.0	96

[a] Bjorksten Research Laboratory (Report presented July 1952); [b] Owens-Corning Fiberglas Corp. (Report presented July 1952); [c] Robert Stunman, Garan Chemical Corp. (Report presented July 1952); [d] H. M. Jellinek, Linde Air Products (Report presented July 1952); [e] J. V. P. Torrey, Du Pont (Report presented July 1952).

Plusses in Plastics File Drawers

Light weight means less worker fatigue; finishing is eliminated; assembly is speeded

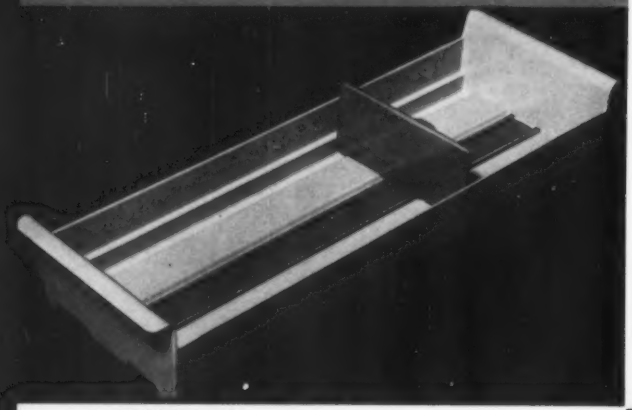


Courtesy Tab Products Co.

File cabinet drawer, with reinforced plastics body and styrene alloy front, is only half as heavy as comparable metal unit

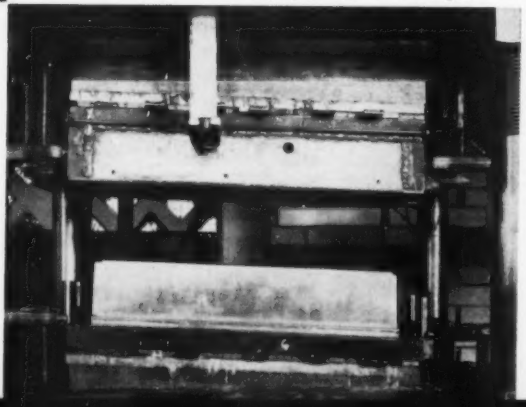
SOMEWHAT of a revolution in office equipment is presaged by the recent development of a fibrous glass-polyester reinforced plastics card file cabinet drawer and a work tray made of the same material. The manufacturer is Tab Products Co., San Francisco, Calif., and the molder is Automatic Plastic Molding Co., Berkeley, Calif.

Main purpose of the originators in swinging from steel to reinforced plastics was to cut down weight since both units are handled by girls. The plusses are many: no finishing is required, transportation costs are lowered, denting is eliminated, and assembly into cabinets is speeded up. Each 3263-card-capacity drawer weighs a little less than 3½ lb. or ½ the weight of a comparable metal unit; in a 20-drawer file this repre-



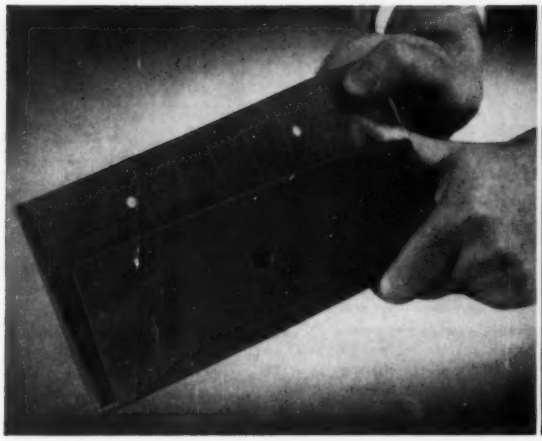
Courtesy Tab Products Co.

Work tray, also molded of fibrous glass-polyester reinforced plastics, has smooth, outward sloping edges to facilitate the filing of cards

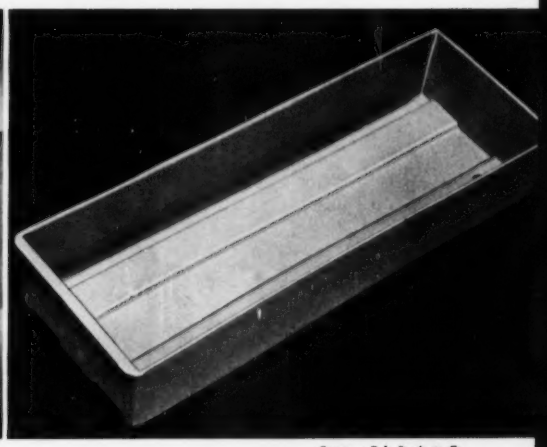


Press for molding the reinforced plastics file drawer. Matched metal molds for drawer were fabricated of steel and hardened

Courtesy Automatic Plastic Molding Co.



In assembling file drawer, the flexible molded styrene alloy front is easily and securely snapped into place over the front wall of the box



Courtesy Tab Products Co.

Basic container, shown as it comes from the mold, is designed with tapering sides to guide cards into proper alignment

sents a total weight saving of 70 pounds.

As is usual with a switch from metal to plastics, a complete redesign job had to be done. The new drawers are a shorter, more handleable 24-in. length. Also, drawer sides are wider apart at the top than at the bottom: this inward taper guides cards into alignment after hitting the drawer bottom, thus making for faster filing of cards.

The conventional ball bearing cradle system was eliminated and is superseded in the new Tab file by a simplified single drawer suspension. Removal and return is smooth and exceptionally quiet, with no tendency of drawers to inadvertently slide open after closing. There is no need for lubrication and there is no metallic clatter.

Due to the design, the file drawers may be removed from the cabinet and stacked. Facing bottoms and tops interlock securely with no shifting or damaging of cards. The drawers are an aluminum-gray in color, the mixing of pigment being done by the molder.

The simplicity of the design may be appreciated by a study of the assembly of the drawer front to the actual container. This drawer front, molded of Dow 475 styrene alloy material in gray color, also by Automatic Plastic Molding Co., is a unique piece of molding which snaps over the front of the box to make a complete drawer.

Work Trays

The work trays have molded ends rather than ends of styrene alloy and have outward sloping ends to give V-action of cards for faster reference and filing. Edges are rounded and smooth.

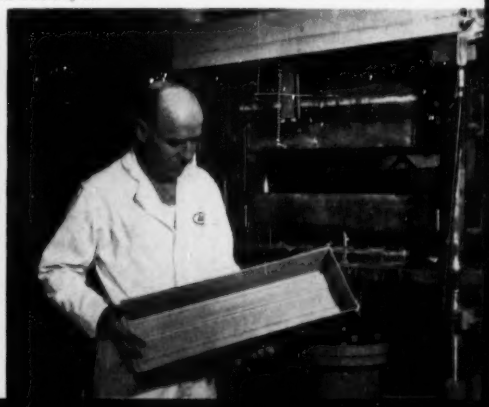
Fiberglas was the chosen reinforcement, performed on an adapted Turner preformer by Automatic. Selectron 5083 was the molding material. Molds were matched steel, fabricated and hardened.

On a point that always comes up when plastics supersede materials in applications of this type—the point of economics—the manufacturer reports that a steel file made with the same specifications would cost 20% less. But the advantages in handiness, lessening of operator fatigue, and lowering of transportation costs more than make up for this difference and make the reinforced plastics an ideal material for the job.

Before closing the press, operator pours polyester resin over the mat of fibrous glass that has been laid to the required thickness on top of the mold

Cured drawer, after removal from the mold, needs no finishing before being sent through the assembly operations

Photos courtesy Automatic Plastic Molding Co.



Resin-Glass Air Blenders

Concealed resin-glass air blender for new heating system can be economically and easily installed in old homes. Flexible blender is inserted in place by simply slipping it through one of two small openings cut into the wall

Photos courtesy Coleman Co.

Metal headers for supporting intake and outlet grilles are attached to the blender body by a slender steel strap and a self-stretching banding seal

In new home installation, the resin-glass blender is raised into position and securely fastened to the wooden wall studs by nails driven through holes in metal brackets that fit around the grille opening

IN a completely new approach to the construction of home heating units, a resin-impregnated fibrous glass insulating material has been successfully incorporated as an integral part of a modern warm air heating system for old or new dwellings.

The material, called Ultralite, is used in the Blend-Air heating system, manufactured by Coleman Co., Wichita, Kan., in the bodies of concealed box-shaped air blending ducts. In operation, the blender serves as an area in which heated air rising from the furnace and an equal amount of air drawn in from the room are mixed together before being discharged back into the room.

Previous to the adoption of Ultralite, the blenders were constructed entirely of steel and were limited in use by their bulk, weight, and difficulty of installation behind the walls of old dwellings.

Steel Replaced

By replacing steel with Ultralite in the blenders, the Coleman Co. offers a simple and inexpensive method of installation. In contrast to the steel blenders, which required a laborious and messy job of cutting away most of the wall space, the Ultralite blender can be installed in any existing dwelling by cutting only two small openings. Since the material is exceptionally flexible and always returns to its original shape, it can be slipped through either of the openings and will readily conform to the stud space once it is inside the wall.

Ultralite, a product of Gustin-Bacon Mfg. Co., Kansas City, Mo., is made from long glass fibers bonded together with phenolic resin supplied by Bakelite Co. It is a resilient, light weight material, with excellent insulating and sound absorbing qualities, and is fire-resistant, non-corrosive, and dimensionally stable.

In packaging for shipment, the material, in the form of slender box-like tubes—approximately 3½ in. deep, 12 in. wide, and 6 ft. long—can be folded down into a small, convenient carton; weight is less than half that of the shipping weight of steel blenders.

NEWS AND VIEWS OF PLASTICS PROGRESS

STOKES *plastics review*

VOL. 2

NO. 1

1953

PUBLISHED BY F. J. STOKES MACHINE COMPANY, PHILADELPHIA 20, PA.

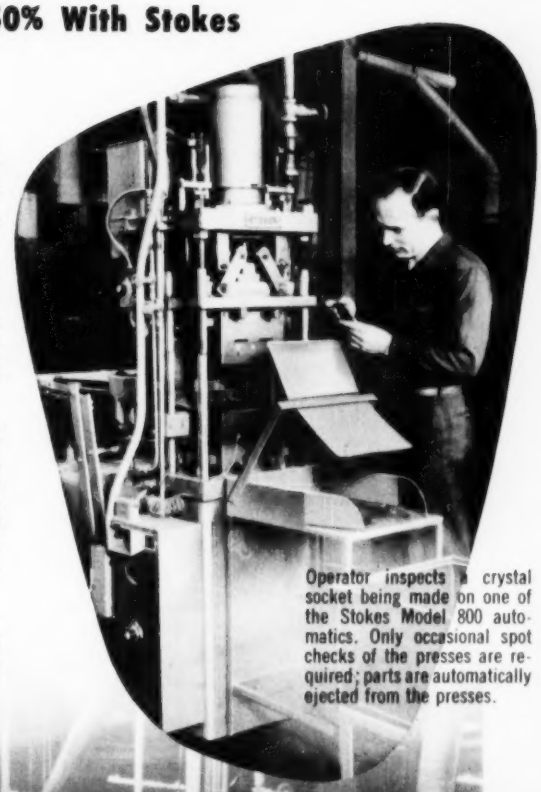
Sylvania Boosts Production 50% With Stokes New Model 800 Presses

Sylvania Electric Products, Inc., Warren, Pa., recently installed a battery of five new Stokes Model 800 plastics molding presses to make fifteen different plastics items, including automobile-type fuse holders, fluorescent slim-line lamp holders, and radio crystal sockets.

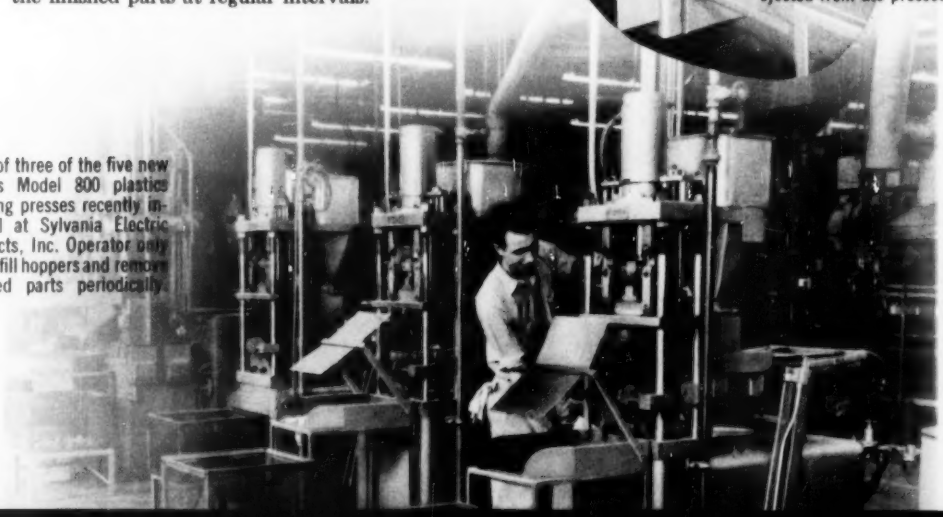
"Production on these parts has increased 50% since we began making them on our new Stokes Model 800 presses," reports H. A. Wagner, Supervisor of Plastics Engineering for Sylvania. "Production *costs* have been lowered, too, because no additional molds are required to take care of increased production requirements."

A wide variety of identically accurate parts, all sizes and shapes, are produced by means of automatic plastics molding at Sylvania Electric Products, Inc., for use in lighting fixtures and radio and electronic devices. In addition to the latest battery of the new Stokes Model 800 plastics molding presses, Sylvania also has installations of other Stokes fully automatics, including Models 741, 200D-3, and 252.

Stokes automatics reduce labor to a minimum. One operator can handle a battery of a dozen or more, his "work" consisting only of filling the hoppers with molding powder and removing the finished parts at regular intervals.



Operator inspects a crystal socket being made on one of the Stokes Model 800 automatics. Only occasional spot checks of the presses are required; parts are automatically ejected from the presses.



View of three of the five new Stokes Model 800 plastics molding presses recently installed at Sylvania Electric Products, Inc. Operator only has to fill hoppers and remove finished parts periodically.

STOKES

EDITORIAL

One of the major developments now clearly discernible in the plastics field is the extrusion of rigid pipe, rod, and shapes. Custom extruders—and even some who are new to plastics extrusion—are seriously examining the implications of this new field.

Extrusion of rigid plastics promises to be a big money-making opportunity. Thinking of pipe alone for the moment, and ignoring rods and shapes, let's note a few revealing facts. Practically every building in America except pup-tents has pipe in it. 5% of total plant investment is in pipe of one sort or another. A recent inquiry among 22 process plants—note that figure: just 22!—discloses that they have a total of over 5,000 *miles* of pipe.

One smokeless powder plant has over 700,000 feet of pipe. A 15,000-barrel-per-day refinery has 350,000 feet of pipe.

Lots of this pipe must be resistant to corrosion by acids, alkalies, and other chemical forms. That's where rigid plastic pipe comes in. Authoritative estimates place the demand for rigid PVC pipe within the next five to ten years as high as 100,000,000 pounds annually.

Rigid PVC pipe is light. It's easily handled. Freight costs are lower than on metal pipe. It is easily installed with available plastic pipe-fittings. Bending is done by hand with the help of a hot-air gun. Supports, though spaced more closely, are far less in total weight.

Cost, and metal conservation, are factors, too. Rigid pipe, slightly higher priced in some forms than metal, will be made in steadily increasing volume at steadily decreasing cost. Its use as replacement for old metal pipe will permit a useful addition to the reserves of scrap metal. Moreover, for many purposes, it is better than metal pipe. Corrosion resistance to chemicals is high. There is no galvanic corrosion and no build-up.

Extrusion of rigid pipe is here to stay. Enterprising operators are now in the field . . . others are making plans to be. Today's trends will be tomorrow's tides. And when the tide comes in, there'll be plenty of business for all.

If you're in plastics, you can't overlook rigid pipe extrusion!

New Model RC-100 Stokes-Windsor Extruder Speeds Production, Simplifies Maintenance

The swift acceptance of the Stokes-Windsor RC-100 during the past year, and the growing number of uses to which it is being applied, have suggested opportunities for advanced design which would further increase its usefulness.

Rigid pipe, because of the growing demand, has inspired a substantial number of installations of Stokes-Windsor Extruders. Plastic shoe welting is another product being turned out, literally "by the mile". Tubes, tapes, belting, channels, moldings and many other sections are also common products on these versatile machines.

Sheet can be made in widths up to 54 inches; in thickness as low as 8 mils . . . even 3 mils by the inflation process for making blown film.

Tubing can be made in a range from tiny surgical tubes up to diameters of 22 inches.

In the new RC-100 Stokes-Windsor Extruder water-cooled oil feeds through all thrust washers. An increase of 50% in thrust washer area permits the machine to handle substantially greater extrusion loads with corresponding increases in production.

A spring-loaded clutch has been added to the feeder so that resistance from random foreign particles in the raw material will throw the clutch and prevent damage to the feeder mechanism.

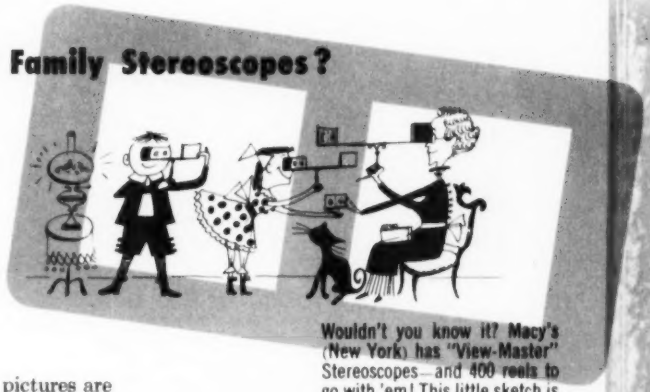
A splined screw design permits easy removal of the working section of the extruding screws. Thus change of compression ratio is greatly simplified. The rear portion of the screws and the thrust washer assemblies are undisturbed.

A new type of flange barrel mounting eliminates tie-rods and hinged adapter plates facilitate set-up and take-down time. Both of these developments make cleaning and adjustments much easier.

There will shortly be a new bulletin available on the new model of the RC-100 Stokes-Windsor Extruder.

Newest model of the RC-100 Stokes-Windsor Extruder. Nominal capacity is 100 pounds per hour but the machine will operate at substantially higher rates. Larger and smaller models are the RC-200 and RC-65.

Remember the Old Family Stereoscopes?

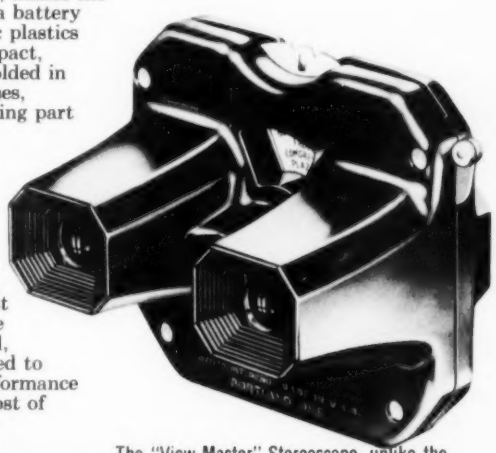


Wouldn't you know it? Macy's (New York) has "View-Master" Stereoscopes—and 400 reels to go with 'em! This little sketch is borrowed from one of Macy's ads.

Looking at stereoscopic pictures in the family parlor was a favorite pastime a generation ago. Now it's a new recreation with modern equipment. The old wooden family stereoscope has been replaced by a plastic stereoscope, widely used today to show a diversity of full-color Kodachrome transparencies produced in amazing three-dimensional realism. The pictures are taken with a stereoscopic camera to impart the true three-dimensional effect.

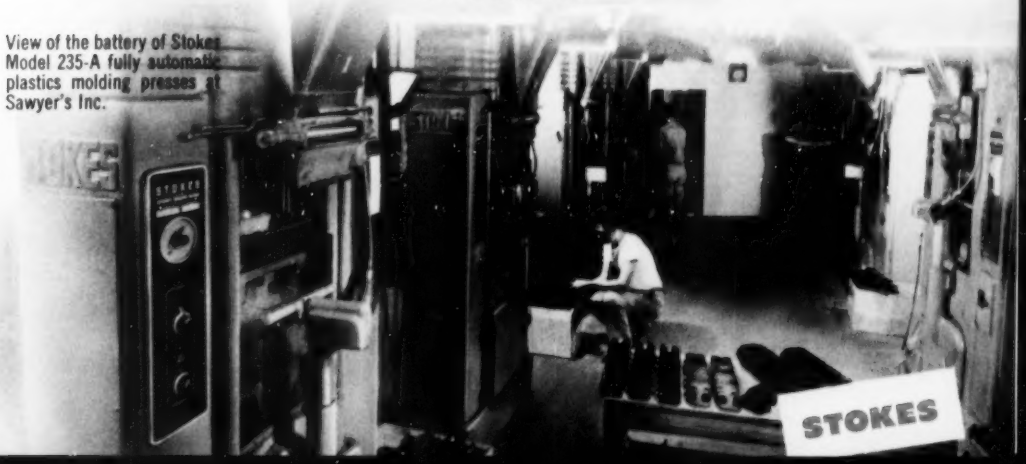
Sawyer's Inc., Portland, Oregon, makes the "View-Master" Stereoscope on a battery of Stokes 50-ton fully-automatic plastics molding presses. The light, compact, and durable case is precision-molded in two parts. Optically-ground lenses, diffusing windows, and one moving part are added, and the two halves are then fastened together. The resulting dimensional stability built into the instrument assures permanent optical alignment.

Starting as a small-scale postcard business, Sawyer's Inc. has grown into one of the largest manufacturing enterprises in the Northwest. Their well-organized, high-speed assembly line is geared to keep pace with the efficient performance of their Stokes presses. Retail cost of the "View-Master" Stereoscope has not increased during the past six years, due in part to the efficiency of automatic molding.

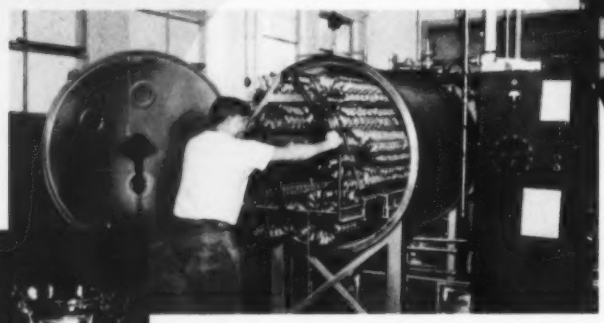


The "View-Master" Stereoscope, unlike the old familiar family stereoscope, is a neat, hand-size, light-weight precision optical instrument. Views are changed by operating the lever at upper right.

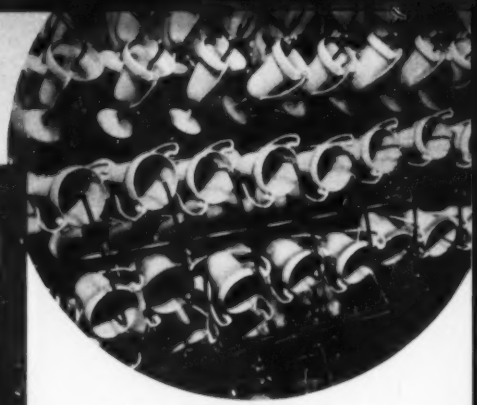
View of the battery of Stokes Model 235-A fully automatic plastics molding presses at Sawyer's Inc.



Operator at Jayron Corporation, Leominster, Mass., loads the Stokes Model 426 Vacuum Metallizing Unit with loving-cups which are to be finished like silver. Aluminum is the material chiefly used by Jayron for the metallic coating. Note the great number of cups which can be metallized at one time.



Close-up of the loving-cups after metallizing. Cups are now finished products; no buffing or finishing operations are necessary.



Close-up of the uncoated loving-cups on the spindles of the vacuum metallizing unit. These spindles, called "spiders", fit in a removable frame and are driven from outside the chamber through a rotary vacuum seal. Attachment of pieces and installation in the chamber is a simple operation.

All That Glisters is not Gold . . . Or is it?

Well, it's gold to firms that are using the vacuum metallizing process to give brilliance and salability to plastic products. Profits are mighty attractive.

Plastic loving cups, jewelry, decorated housewares, automobile accessories, Christmas ornaments, and figurines are among the many items which Jayron Corporation, Leominster, Mass., metallizes in its Stokes Model 426 vacuum metallizing unit. Jayron Corporation is a leading processor in the rapidly expanding vacuum metallizing field.

Before metallizing, a base coat of lacquer is applied to produce a mirror-like finish when the metal coating is applied over it. Aluminum, the metal chiefly used at Jayron, is then applied to the surfaces of the lacquered plastic products to produce true metallic finishes. A top coat of lacquer follows to provide protection and a durable finish. By dyeing the lacquer top coat the pieces can be made to simulate the color of gold, copper, and other metals.

Many low-cost "metal" products are now made of plastic, thanks to vacuum metallizing. The process requires so little metal that only eleven ounces of aluminum, vacuum-metallized, would cover an entire football field!

"This Machine is on Automatic Operation—KEEP CLEAR"

Fully automatic molding is saving time and cutting costs for many plastics molders, among them the Belden Manufacturing Company of Richmond, Indiana, and Chicago. Belden makes electrical cords for many appliances, complete with protective molding, plugs and connectors; insulated cables for automobiles, aircraft, welding outfits and neon signs; magnet wire and rubber-covered lead wire.

Plastic shells for the connections of electrical appliances are made on Stokes 741 and 200-D presses, the latter in their fifth year of satisfactory operation. Belden executives say that in addition to the usual advantages of automatic operation, Stokes presses make higher quality parts and have been ideal for the jobs assigned to them at the Belden plant.

The Stokes 741 is a high-speed fully automatic 50-ton hydraulic press designed for low-cost production of precision parts. The 200-D, a veteran of several years' service in the Belden plant, is a 15-ton fully automatic press.

"Look, ma; no hands." Also no feet, no man . . . except occasionally to replenish molding compound. This is a Stokes 741 fully automatic press in use at Belden Mfg. Co., Richmond, Ind.

STOKES

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NYLON JACKETS FOR CONNECTORS

Nylon jacket conforms to the deeply staked indentation in terminal barrel

Soldering and taping of electrical cables is eliminated by use of nylon jackets

Photos courtesy The Thomas & Betts Co.

A COMPACT, easily installed electrical fitting that eliminates the need for hand splicing, soldering, and taping is made possible by the use of nylon jackets on self-insulated wire and cable connectors manufactured by The Thomas & Betts Co., Elizabeth, N.J.

The nylon jackets were originally developed for small pigtail type connectors which could be staked to wire leads with a pressure tool, but the application has now been expanded to include large self-insulated cable terminals, up to ½ in. in diameter.

In preparing these cable terminals for use, the nylon jacket, molded by Brillhart Molding Co., Mineola, L.I., N.Y., is held in place by a snug fit around the terminal barrel until the fitting is installed at the end of an electrical cable. When the fitting is then staked under hydraulic pressure, both the insulating nylon and the terminal barrel are simultaneously deformed until the barrel becomes an electrical unit with the cable. The flow of the nylon under pressure of the tool is so complete that it exactly conforms to the deeply staked indentation and is thus firmly secured to the terminal barrel.

For the pigtail type of connector, the metal bodies are pre-assembled on pins in the mold and are then molded into the nylon jackets as inserts. This job is done by Thermold Corp., Manlius, N.Y., and Cowan-Boyden, Inc., Providence, R.I.

Much test work and field experience preceded the selection of nylon as the most satisfactory insulating material for this job. Besides withstanding the stresses—as high as 40,000 p.s.i.—set up by the staking tool, the nylon can withstand 6000 volts in the staked area without puncturing. It is tough and resilient under severe service conditions, inert, and not affected by most solvents or oils. The nylon can also withstand higher temperatures than most wire insulation and will not grow brittle with age. In pigtail type connectors, the translucency of the nylon permits visual inspection of the wire leads after the connectors are staked.

Testing apparatus registers depth of tool indentation and resistance of nylon

BATH TUBS OF

Courtesy Seaform Molded Products Co.

Lightweight bath tub, molded of polyester reinforced with fibrous glass, is designed to resemble conventional enamel type. Tub will not chip or dent under severe impact; it can be simply and inexpensively installed using standard fittings; and it is easily cleaned

THE reinforced plastics bath tub is here. At least two companies are making such tubs, using a combination of fibrous glass and polyester resins, and both firms see an excellent sales potential for the product, which has many points of superiority over tubs made from conventional materials.

Present indications are that reinforced plastics tubs will find their most immediate market outlet in the trailer field. Since light weight is a prime requisite of all trailer furnishings, the glass-polyester tubs are a natural for this application. In addition, such problems as FHA testing and approval, which will have to be settled before the tubs can be used in the home building field in large volume, do not apply to house trailers. It might be said that the trailer-type bathtub application roughly parallels the reinforced plastics sports car body (see p. 75), in that both fit a special type of market which will serve as an excellent proving ground and stepping stone to broader applications.

Seaform Molded Products Co., Mt. Clemens, Mich., makes a variety of fibrous glass reinforced products ranging from amusement park boats and carnival ride bodies to weatherproof tops for convertible cars. However, according to L. G. Stedman, Jr., general manager of the company, the trailer bathtub is now Seaform's most popular item. Currently being sold to many of the leading trailer coach manufacturers, the tub weighs only 15 lb., compared to approximately 150 lb. for a steel tub and up to 350 lb. for cast iron.

Reduction of dead weight in a trailer coach, through use of the plastics tub, means better highway performance, increased "pay load," lower fuel consumption, and reduced tire wear. The chip-proof quality of the Seaform tub, along with its great durability and ease of cleaning, is a further point of superiority.

Another producer of reinforced plastics bath tubs is Strand-Plax Building Products Co., Birmingham, Mich. This company is offering the tubs in the following range of sizes: 46½ by 28 by 14 in. high; 54 by 28 by 16 in.; 60 by 29½ by 16 in.; and 54 by 27 by 14 in. The latter size unit is being made for Strand-Plax in matched metal dies by Molded Resin Fiber Co., Ashtabula, Ohio; the other three tubs are produced by Replac Corp., Cleveland, Ohio, using a bag molding process.

All development and experimental work on these tubs was conducted by Strand-Plax under the direction of C. H. Van Hartesveldt, chemical engineer. The company, which controls all the specifications and will probably control all production of the tubs, is headed by C. A. Strand, who pioneered such building innovations as the steel overhead doors for garages. At present, the Strand-Plax tubs are getting into initial production, with major sales emphasis on the trailer coach field and a num-

REINFORCED PLASTICS

Trailers are the initial market; housing developments are next. Light weight, rigidity, reduced cost, and built-in color are important factors

ber of successful installations already completed. A distribution arrangement for the home market has not yet been established. Production is now around 40 tubs per day, and estimated potential capacity is 500 units daily.

The Strand-Plax tubs, according to Mr. Van Hartesveldt, weigh from 15 to 20 lb., depending upon size. Although final cost figures are not yet available, in view of relatively high start-up costs and an extensive preproduction development program, indications are that the tubs may ultimately sell for from 10% to one-third under the price of steel and porcelain tubs.

Strand-Plax's original work was done with a bag molding process and about 20 molds are now available for this type of production. Minor bag wrinkles encountered in this process are minimized through the use of a thin polyvinyl alcohol sheet. Fibrous glass mat and a hand layup technique are used in the bag molding work. The matched metal dies used for the tub produced by Molded Resin Fiber Co. were made by Gaugler Machine Tool Co., Kent, Ohio. Tubs made by both processes are designed for installation with standard plumbing fittings. Despite their light weight, they are very rigid because of the curved surfaces present. Two types of bases are provided which afford a firm, non-rocking support. Flanges on the sides of the tub are identical in appearance to those on metal tubs.

Gel-Coat Finishes

An interesting feature of the Strand-Plax tubs is their use of gel-coat finishes which are sprayed directly into the mold, enabling the company to offer a variety of integral colors without supplementary finishing operations. This mold coating, which is approximately 0.020 in. thick, is based upon a polyester formulation characterized by unusual abrasion resistance. All polyester resins used in the production of these tubs is supplied by Glidden Co., Cleveland, Ohio, which worked closely with Strand-Plax in connection with this program. Exclusive of the surface coating, the wall thickness of the tubs is approximately 0.060 to 0.070 inch. In addition to carrying the color, the mold coat layer masks the fibers and provides a smooth surface comparable to that found on conventional metal tubs.

Production of the Strand-Plax tubs was preceded by more than half a year of experimental work on such problems as porosity, proper application of mold coatings, correct design of the matched metal molds to maintain proper wall thickness, and mold cut-off to eliminate voids in the moldings. The program is now under way, however, and the company believes that excellent market opportunities exist for the reinforced plastics tubs.

In contrast to the 180-lb. conventional enamel bath tub (left), the reinforced plastics tub, weighing only 17 lb., is especially suitable for installation in trailers

Courtesy Owens-Corning Fiberglas Corp.

Vinyl Film and Sheeting Conference

Recorded—and off-the-record—report of speeches and conversations by and with industry members in the process of scolding each other

VINYL film industry members spent two days scolding themselves at the recent Film, Sheeting, and Coated Fabric Conference of The Society of the Plastics Industry. But an impartial observer may well have asked: "Who was scolding whom?"

Retailer, designer, converter, film producer, equipment supplier, and resin producer all took turns in recommending that some other branch of the industry could and should do a better job or they would all go down together.

Why was this murky atmosphere so prevalent on the speakers' rostrum during the greater part of the meeting?

The answer is that vinyl film production (under 10 mils thick) has failed to grow in volume for the last two years, while all other branches of the vinyl industry have shown steady increases. After a phenomenal increase from around 80 million lb. in 1949 to something like 130 million lb. in 1950, there was no further growth in 1951 and 1952. The industry will not accept the 1950 figure as a saturation point. Producers are believed to have capacity to manufacture 30 or 40% more than that amount of film on a yearly basis. Most of their equipment is comparatively new and extremely high in cost—some say that one calender and all the necessary equipment are worth at least a half million dollars today.

Very few calenderers have had enough time to amortize their capital expenditure. The price structure has been far from stable. It has ranged from 52 to 65¢ a lb., with sometimes almost as many different quotations as there are calenderers. Profits have not been all that was expected and almost everybody is piqued. The film manufacturer is disappointed because the expected increased volume has not been forthcoming and the converters and fabricators are annoyed because consumers have not continued to storm retail counters.

Perhaps the vinyl film part of the industry is just beginning to realize what it was told at a Hyatt Award Meeting in Chicago some years ago by the president of Marshall Field who said: "The more goods you have to sell, the more difficult it will become to sell."

Merchandising Genius

So-o-o, a lot of people are or were unhappy. That is, they *were* unhappy when the convention program was arranged several months ago. A critical program was deliberately arranged whereby everyone could let down his hair. But now things are different. Calender rolls have been purring beautifully for the last few months. Business is on the way back in a big way and the blues song has been changed into a marching song. Today, the industry is full of merchandising genius. Yesterday there was none at all.

"The price structure has been far from stable. It has ranged from 52 to 65¢ a pound, with sometimes almost as many different quotations as there are calenderers."

The talk in the halls and corridors at the conference was much different from that on the rostrum. Sales are rolling in, so why not forget past troubles, said one man at his supplier's cocktail party. The film industry is like that. When the grapes are ripe, eat 'em and have fun. Maybe we can get by without all that pruning and spraying and fertilization that the book says is necessary before a good crop can be expected year after year. In other words, when sales are good in October and November, it is easy to forget the pain and anxiety of last April, May, or June.

The vinyl film industry is perhaps still too new to practice the art of preparing for lean days in times of plenty, but all signs indicate that present high volume production is only another of those pleasant but temporary boom periods. Practically every speaker at the meeting warned of trouble ahead.

Wonderful Material

The consensus of all the speakers was that vinyl film is truly a remarkable, valuable, different, attractive, long-lasting product to add to the world's family of materials. But, and it was a big but, past errors must not be recommitted; quality must be maintained and, in some cases, improved; imagination must be employed to take advantage of vinyl's favorable properties.

Here are some of the good things that were said about vinyl film which need to be emphasized:

Improved printing and embossing techniques are steadily adding to the material's beauty appeal. More than 35% of all film is now surface printed. Embossed film is rapidly driving plain surface material from the market.

A large mail order firm's sales of vinyl film were increased in 1952 because it advertised the material what it was. That is, top 4 mil thick quality was advertised as such—poorer grade 3-mil film was described as less satisfactory than top grade. The customer was informed of what to expect.

A large chain store buyer said much improved styling in 1952 had resold his customers on vinyl drapes.

The industry is aware of a need for measuring standards of quality and is attempting to do something about it.

A buyer of the largest retail store in the world said: "The plastic business is extremely profitable and I intend to keep it that way."

Customer Appeal

Practically everybody agreed that vinyl film as a new and different material has plenty of customer appeal if it is used for the right pur-

pose. The problem is to find and stay on the right track. Perhaps the extreme efforts to enlarge its acceptance as a drape is wrong. It has already taken over the paper drape market and a good portion of the kitchen and bathroom market. Maybe that is all that can be expected. More effort might be profitably expended in finding other uses where the superb properties of vinyl film can be employed for other purposes. It is no secret that the material will move slowly if printed to look like fabric and offered at the same counter and at the same price as actual fabric.

Here are some of the complaints that were registered at the conference:

Most damning of all was the accusation that vinyl drapes had become known as a basement item. Until that onus is overcome by high styling and superior quality, markets will be limited. One speaker challenged the audience directly on this point: "How many of you here in this audience have vinyl drapes in your living room or bedrooms?" Another speaker declared that buyers refused to stock vinyl drapes because they did not enhance the value of the department.

The entire vinyl film market is affected by this low cost problem. Even shower curtains, which have

"There has been a vast improvement in design, finish, and construction of all vinyls since their introduction."

shown great improvement in styling and quality over the last year, are caught in this quandary of whether or not it is possible to make the same material serve the same purpose in a king's palace or a peasant's bathroom. Designers say it may be done. Perhaps flocking, laminating, or combination with fabric is the answer. A flocked tablecloth, a vinyl-laminated-to-fabric or other vinyl drape, a laminated or coated rainwear material might be the answer to vinyl film expansion.

Unfortunately, a few opportunists got into the industry early and promoted the basement trend, according to one speaker who said that such activities gave the product a reputation for being 'cheap and poor' when it should be promoted as a "good and attractive" product that will serve the upper income groups just as satisfactorily as the so-called poor groups.

Another speaker said that the vinyl film industry had become tired—too tired to envision new styling that would spur competition and awaken new interest in customers. The business of copying other materials leads to cries of 'phoney,' he said.

The above paragraphs give the general trend of the criticism—the main points were that vinyl film had acquired a basement reputation even though unjustified; quality varied so that the good suffered with the bad; designing had taken little advantage of the vinyls possibilities; the customer still doesn't know nearly as much as he should about vinyl film.

Helpful Suggestions

Following are some of the suggestions that were made to help allay the complaints: :

Several speakers insisted that the vinyl industry must do a better job in explaining the properties of its product. One mail order house has distributed a million circulars describing plastics and has sent a traveling laboratory around the country showing consumers how to handle these materials. Another critic bewailed the use of the word "plastics" in describing vinyl products—he wants them called "vinyl." He said "plastics" connotes low cost material to the rank and file consumer and something must be done to overcome the prejudice.

Another critic asked that the raw material companies allocate huge advertising budgets for the sole purpose of helping the public to understand vinyl. Continuous campaigns should be telling the consumer about various vinyl products, describing end-use, quality, how-to-buy, and tags to look for. Retail advertising was panned because a great many copy writers did not seem to have any idea of what to say about vinyl except that it could be wiped clean with a damp cloth.

At the same time, film producers were also urged to get out and learn more about the items which were being made from their film. One speaker implied that the customer or user of vinyl film can contribute many constructive ideas on style, design, and quality—but she has seldom been asked.

Vinyl drapes need a new approach, said one buyer. They must have a differential with the cloth price and, most of all, customers must be able to point to them with

"A set of standards that will permit use of a hallmark only to those who can meet certain specifications is urged by many as the only answer to the quality problem."

pride, not apologies. The place of vinyl drapes is with the consumer with good taste but limited budget. There was even a suggestion that the material be described as 'fabric' to increase its appeal.

Better Styling Demanded

The demand for better styling and better film quality permeated the talk all through the meeting, the climax of which was a last day show in which the speaker gave visual evidence of good and bad products. He littered the platform with poor examples of vinyl drapes, raincoats, baby pants, and aprons that he tore to pieces. Side by side with the inferior goods, he displayed fine examples of similar products to show that satisfactory items of these same products can and are being made from vinyl, but their sales are hurt by shoddy imitations that should never be permitted on a retailer's shelf.

The industry was scolded time after time for not doing a better job in designing and styling. But there was certainly a paucity of information on just how to take advantage of vinyl's qualities for producing a new type of design. Designers and merchants rant and rave on this subject every time they can find an ear to listen, but where are the ideas to come from if they themselves cannot produce them?

Of course, there are still many cheap, gaudy, and loud designs in vinyl goods, but so are there in all

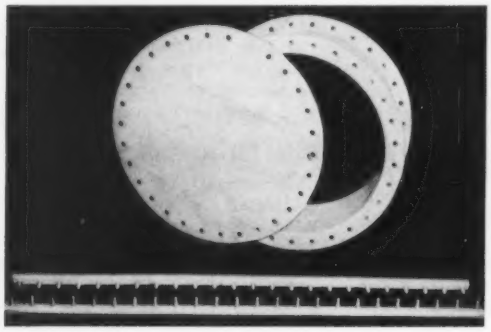
(*Continued on p. 200*)

Photos courtesy Murdock Tank and Mfg. Co.

Curved reinforced plastics sheets which will be assembled to form the walls of an oil tank are produced in a tilting head hydraulic press

Tops and bottoms of oil tanks are made up of pie shaped segments, one of which is shown being removed from the press in the photo

Bolts for tanks are protected from corrosion by molding heads into assembly channels (bottom). Hatch is also of reinforced plastics



Completed tank made up of wall sections (left, above), pie shaped segments for top and bottom (above), and access hatch (left, below)

Tanks for Everything

REINFORCED plastics have been invading the field of tanks for some time. The excellent resistance of the materials to weather and corrosion make them highly attractive for use in tanks in the oil fields, in chemical plants, for fuel transportation, and in similar applications. Now the invasion is an accomplished fact. The tank field—formerly held almost completely by metal, rubber, acid-proof brick, and wood—has welcomed reinforced plastics for their properties already mentioned as well as for their extreme lightness on a comparative weight-strength basis. Tanks of these materials are now being made in a wide variety of sizes and shapes. Their applications are almost as diversified.

The seriousness of the corrosion problem in tanks is exemplified by an investigation which is now being made by a large manufacturer of steel tanks for oil storage. The study encompasses the use of plastics and of plastic coatings for steel plates. This manufacturer states that practically all oil as it comes from wells is accompanied by water ranging in relative volume from very small quantities up to sizable amounts. This water is usually salty. As a result, the interiors of storage tanks, and particularly the bottoms, are constantly subjected to salt water corrosion. The interior decks of the tanks, it is stated, are particularly prone to this corrosive effect. Oil from wells in the Permian Basin of western Texas and the fields of Kansas, Wyoming, and Arkansas is often accompanied by hydrogen sulfide gas or gas containing more obscure sulfur compounds, some of which give rise to violent corrosive actions. This manufacturer further states that bolted steel tanks have been known to corrode through in as little as six weeks.

Although the present investigation

has revealed that the proportion of violently corrosive oil is usually small, the number of tanks subjected to this type of corrosion is large. Included in the report on this work is an outline of unsuccessful attempts which have been made to stop this corrosion by coating the interior of the tanks with multiple layers of lacquer or bitumen type coatings. The bitumen type coating dissolves in the oil; pin-holing is prevalent in the lacquer coatings.

Molded in Sections

The research briefly described above is being pursued by a manufacturer who at present must remain anonymous. On the other hand, Murdock Tank and Mfg. Co., Tulsa, Okla., is already furnishing reinforced plastics tanks with capacities ranging from 250 to 750 barrels. Because these tanks, built to API molded tank specifications, are molded in sections, shipping is greatly simplified. Since the sections are produced by a molding process, it is possible to add additional thicknesses at the bolt line so that after the bolt holes have been punched the strength at the bolt line is at least equal to that of the rest of the tank.

All decks in the Murdock tanks have two corrugations in each section; by using a reinforced plastics bolt channel for assembly, sufficient strength is gained to make it possible to eliminate all inside deck supports. A white pigment is added to the polyester resin before the fibrous glass is impregnated. Lifetime color is thus obtained and paint maintenance is eliminated.

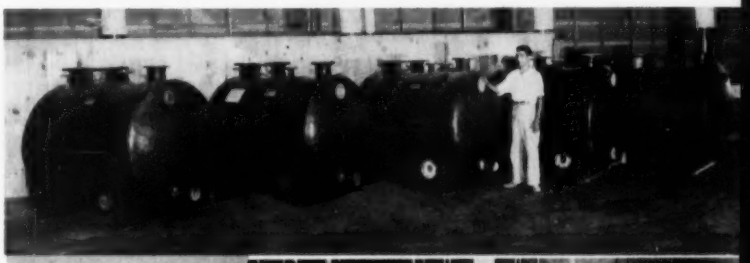
Murdock claims that because of the dimensional stability of the reinforced plastics under severe stresses and temperature extremes the loosening of joints and connections, common with steel tanks, ceases to be a problem. Even the possibility of bolt and nut corrosion is eliminated by molding the bolt heads into the assembly channels and using strips of reinforced plastics to cover all other metal surfaces.

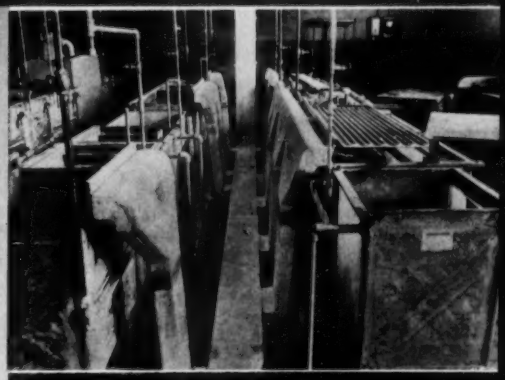
The tanks being produced by Murdock are known as equal segment types. In the assembly of a 250-bbl. tank, the bottom is composed of 10 pie shaped sheets (normal section thickness 0.125 in., thickness at bolt line 0.165 in.) which when assembled make a disk. The side sections are 10 curved sheets of the same wall sections, 5 ft. wide by 8 ft. high. The top of the tank is constructed in the same manner as the bottom. When all sections are assembled, this 250-bbl. tank measures approximately 15 ft. in diameter by 8 ft. high. By adding another ring, making the tank height 16 ft., a capacity of 500 bbl. is obtained. Three rings high gives a capacity of 750 barrels. The company now has plans to fabricate tanks up to 3000 bbl. capacity.

Both the pie and rectangular shaped sections of the Murdock tanks are molded in tilting head hydraulic presses. Sufficient layers of $\frac{3}{16}$ in. thick glass mat to result in a $\frac{1}{8}$ in. thick molded section are laid up and impregnated with pigmented polyester resin. After the molding operation, it is only necessary to trim the flash and punch the bolt holes.

At least one other large concern in Oklahoma now has polyester fibrous glass tanks in the oil fields for test purposes. However, this company states that its tanks will not be placed on the market until the test work has been completed.

Probably the most widespread use





Molded and fabricated reinforced plastics tanks of 500-gal. capacity are used to receive laboratory waste in a mid-West defense plant

Reinforced plastics tanks used in a plating plant include plating tanks, rinse tanks, anodizing tanks, and acid tanks. Exhaust system has reinforced plastics parts

Large reinforced plastics tank in background is 12 ft. long, 3 ft. wide, and 7 ft. deep. Woman in foreground is demonstrating light weight of 12-ft. long reinforced plastics pipe made up of two 6 ft. sections bonded together

Photos courtesy The Chemical Corp.

Courtesy Laminex Corp.

Open top molded tanks for chemicals have easily cleaned rounded corners

of reinforced plastics tanks today is in the chemical field. This includes such processes as electroplating, anodizing, pickling, and solvent cleaning, as well as all sorts of chemical processing.

The Chemical Corp., Springfield, Mass., is reported to be the first company to offer these tanks to the electroplating and chemical process fields. Its line, known as Pla-Tanks, includes many standard and custom design sizes and shapes.

Independent Investigation

This company, a manufacturer of metal finishing solutions and strong in the electroplating field, undertook an independent investigation to determine the most suitable materials for use in its field. After deciding that reinforced plastics were acceptable materials because of light weight, high strength, corrosion resistance, ease of handling, availability, and cost (often lower than other materials), it set out to design and build tanks and duct work to meet the various problems involved. The company paid all the development costs of this work and now has a line of standard molds from which various tanks are produced on a proprietary basis. The company policy, however, is to require that the customer pay a portion of mold costs if special molds are required.

Customers of The Chemical Corp. include such companies as Avco Manufacturing Co., Bridgeport-Lycoming Div., Stamford, Conn.; Bendix Aviation Corp., Eatontown, N.J.; General Electric Corp., Lockland, Ohio; and, according to V. H. Gardner, vice president of Chemical, hundreds of plating plants throughout the country. Mr. Gardner also notes that some of the tanks so far produced were for new applications; some were replacements for tanks made of stainless steel, rubber or vinyl lined steel, and wood or acid-resistant brick lined steel.

The manufacturing process used by The Chemical Corp. is essentially the open layup method in which impregnated glass mat or cloth or combinations of the two are laid up on or in open molds. This company has compiled, out of its research work, some highly interesting reports on the chemical resistance and physical properties of reinforced plastics tanks; some of the tests have been carried on continuously for as long as eleven months. The company rates its reinforced plastics tanks as satisfactory for plating solutions used at temperatures up to 100° F. for brass, copper, silver, and zinc.

Range of Sizes

Laminex Corp., Fall River, Mass., is producing over 20 different sizes and shapes of tanks for use as acid storage tanks, rinse tanks, and chemical processing tanks. These tanks are made in sizes from 13 in. in diameter and 14 in. in depth to 17½ in. in diameter and 44 in. in depth for round containers. Capacities range from 10 to 45 gallons.

Rectangular open top tanks are produced in sizes from 20 by 16 by 18 in. to 70 by 48 by 36 in. and in capacities from 25 to 535 gallons. All of the round containers are available with casters; the rectangular tanks are available as "trucks" by equipping them with large replaceable casters of various sizes.

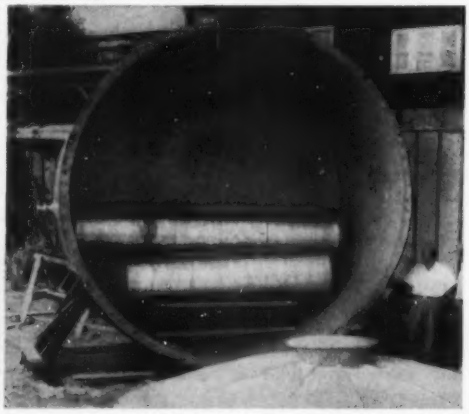
Laminex states that its tanks and trucks cost less than aluminum and far less than stainless steel, yet have many advantages over such metal tanks. Since the reinforced plastics tanks are one-piece moldings, there are no bolts and rivets; the smooth rounded corners facilitate cleaning.

The Laminex tanks are extremely light in weight: a truck measuring 2 by 2 by 3 ft. weighs only about 60 lb.; a 26-gal. container weighs only 14 pounds. Because of the variety of sizes and shapes of these Laminex stock items, various molding methods are used, including bag-vacuum,

Molded reinforced plastics tank for use in an alum evaporating process is completely resistant to chemicals and temperatures encountered in service

Looking down into open top of 14½ ft. diameter chemical process tank shown at the left. Domed cover is in foreground

Photos courtesy The Carl N. Beetle Plastics Corp.



open layup or contact, and compression molding with matched molds. Polyester resins are used throughout; Fiberglas mat and cloth are the reinforcement materials.

Big Tanks

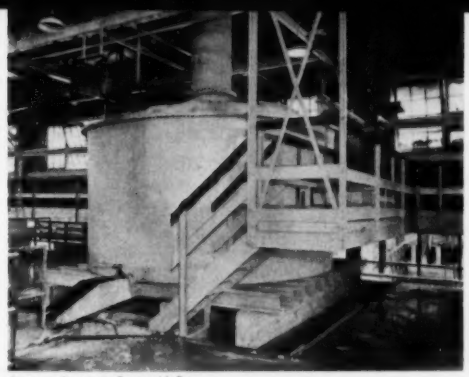
The Carl N. Beetle Plastics Corp., Fall River, Mass., has produced outstanding examples of large tanks on a custom basis. One job involved the equipment of several specially built motorized desert tankers with polyester-glass fuel tanks. This application was completely described on page 76 of the June 1952 issue of MODERN PLASTICS magazine.

The latest Beetle job involved the molding of a tank measuring 14½ ft. in diameter by 8 ft. high, now in use at the Mobile, Ala., plant of American Cyanamid Co. as an alum evaporator tank. Before the full size tank was ordered, accelerated tests were run by Cyanamid in a 50-gal. tank for a five month period. At the end of the test, there was no sign of chemical attack on the interior surface of the tank. Its life should be indefinite for this job.

In the alum evaporation operation the tank is loaded through an open port with alum sulfate liquors, which are evaporated down to dryness in a period of four hours. The temperature is gradually raised from 160 to 242° F. during the cycle. Steam is circulated through stainless steel coils in the tank to achieve this temperature increase. Before the reinforced plastics tank was designed, the evaporating process had been carried out in a steel tank that was lined first with lead and then with acid-proof brick. Because of the corrosive nature of the liquid—it has a pH of three—the maintenance costs were very high and, according to Cyanamid, there was always the danger of product contamination from the brick.

Lower Cost

In this application, the reinforced plastics tank was not only much more satisfactory, but a sizable sum of money was saved as well. The lined steel tanks cost $14,000 each; the Laminac-Fiberglas tank cost but $6500. The weight of the reinforced plastics tank is only 2200 lb.; the steel tank weighed 13,000 pounds. Laminac resin 4119 was selected for this tank application because of its chemical resistance, high heat distortion point, and good curing characteristics which are so desirable when large reinforced plastics objects are being layed up.



Alum evaporator tank set up in a chemical plant. (See also photos at bottom of the opposite page)

Maker of reinforced plastics boats is also active in the manufacture of tanks (below) in a variety of sizes and shapes

Courtesy American Cyanamid Co.

Courtesy Beetle Boat Co.

Diesel fuel storage tank, fabricated of reinforced plastics, is 16 ft. long, 8 ft. wide

Courtesy Palmer Scott & Co., Inc.

In addition to the aforementioned manufacturers, Camfield Manufacturing Co., Grandhaven, Mich. has produced tanks of 1200 gal. capacity from polyester resin and fibrous glass for a specialized application of the Armed Forces. It is stated that in this application the tank weight vs. capacity is approximately 1 lb. per gal. of water. Also, Beetle Boat Co., New Bedford, Mass., is presently custom molding many different sizes of tanks for the chemical and electroplating industry.

Another builder of tanks, largely for government use, is Palmer Scott & Co., Inc., New Bedford, Mass. This company states that, among others, it is making several water tanks which, in use, are subjected to working pressures of 50 p.s.i.; testing pressure is 125 p.s.i. They are made of polyester resin reinforced with glass mat and cloth. Palmer Scott also reports successful construction of a large Diesel fuel tank measuring 16 ft. long by 8 ft. wide which stood up under a test involving a static head of 22 ft. of water.

From these reports on accomplishments in the still new field of reinforced plastics tanks it is obvious that not only are present applications successful but that the future of such tanks is virtually unlimited.

For the musically minded youngster, a clear playing, accurately detailed trumpet is being molded of Bakelite styrene. The realistic trumpet is gold plated and engraved to simulate the appearance of a brass instrument. The Golden Trumpet is manufactured by Emenee Industries, 200 Fifth Ave., New York 10, N. Y.

A safety-red hunting jacket and a transparent hunting license pocket set into the back of the jacket are both made of lightweight, tough Vinylite film to resist wind, water, and weather. The Vinylite, embossed to feel and look like woven fabric, will stay flexible at low temperatures and will resist tearing. Jacket is by Seal-Dri Sportswear Co., 2514 Kilburn Ave., Rockford, Ill.

PLASTICS

A modern dome-shaped skylight that one man alone can easily and securely install in a metal base frame is being fabricated of Plexiglas. The skylight is designed either with a clear finish or an attractive white translucency to meet various requirements for privacy, light, and climate. Called Domelites, they are available in square or rectangular sizes, in dimensions from 20 in. by 20 in. to 64 in. by 96 inches. Made by E. Van Noorden Co., 99 Magazine St., Boston, Mass.

To encourage the savings habit in children, a see-saw bank molded of styrene doubles as a clever and colorful toy. Two comic elephants with a bank slot cut into the back of each one's head stride either end of the see-saw and are moved up and down by inserting coins into the slots. The see-saw bank, in contrasting bright reds, yellows, and blues, is 8 in. long by 5 in. high by 1¾ in. wide. It is manufactured by the Plast-O-Matic Corp., 11 Simonds Rd., Fitchburg, Mass.

Practical design and colorful styling add a note of smartness to a divided serving dish, injection molded of Monsanto's styrene. The large capacity of the tray—2¼ in. deep by 7 in. wide by 11 in. long—and the convenient double compartment made it suitable for combined table servings of pretzels, potato chips, candy, and similar fare. The dish is available in four colors—burgundy, chartreuse, green, and gray. Maher, Inc., 50 Millbrook St., Worcester 5, Mass.

Tie rack, made of flexible Vinylite rigid sheet, has a wide die-cut slot at one end through which doubled-over ties can be neatly looped and then hung on hook or clothes hanger. A flexible carrying case, made of Vinylite film, can be slipped over the rack to protect it against dust, dirt, and moisture while it is in a suitcase or traveling bag. Ties can easily be identified through the translucent case. Distributed by S & S Distributing Co., 43 E. 59 St., New York 22, N. Y.

PRODUCTS

Clear, heavyweight tumblers that bounce instead of break when dropped are injection molded of Bakelite's C-11 styrene copolymer. The tumblers will withstand up to 180° F. heat and can be used in automatic dishwashers without fear of chipping. Their attractive fluted design minimizes the danger of scratching. Tumblers come in three sizes—5-oz. for juices; standard 10-oz.; 12-oz. for iced tea—from International Molded Plastics, Inc., 4387 W. 35 St., Cleveland 9, O.

Durable handle of a new cook saw is molded of high-impact styrene. The tool, which is ribbed for extra strength, has a 6-in. steel blade for cutting bones, frozen foods, poultry, and even ice cream. The entire unit measures approximately 9 in. long by 4 in. high and can easily be stored in the standard knife drawer. Both handle and blade can be cleaned with soap and water after use. The saw, with a red, yellow, green, or blue handle, is by North Shore Plastics, Inc., 12 Norfolk St., Cambridge, Mass.

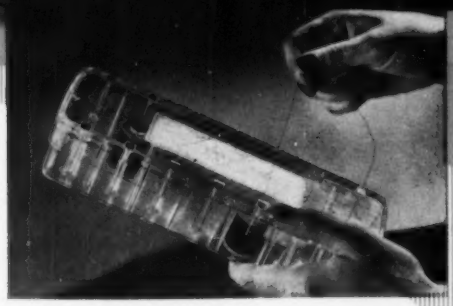
Geography lessons and playtime fun form a partnership in a new 16-in. world globe made of Vinylite sheet. When inflated and set into the base formed by the box in which it is packed, the colored global map is a convenient educational tool. It is also tough and resilient enough to be bounced like a basketball or used as a beach ball. Deflated sphere fits into drawer or pocket. By The Blaine Co., Inc., 130 W. 42 St., New York 18, N. Y.

Keeping equipment dry while deep-water wading is no longer a problem for the fisherman. The Angler's Valet, a carrier made of lightweight, water-proof Firestone Velon, can be worn chest high for perfect protection or clipped on the belt or trouser top. Compartments are fitted with nine various size phenolic-capped styrene containers and a watertight cigarette and match container. The Valet and a matching drawstring Velon case are made by Riverside Mfg. Co., Woodstock, Va.

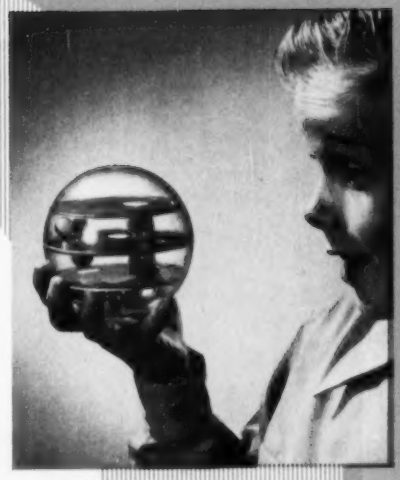
PLASTICS

An unbreakable honey bear, blow molded in one piece of squeezable polyethlyene is a novel—and practical—dispenser for chocolate syrup. To the delight of children, when the toy-like bear is turned upside down and squeezed, the syrup easily pours out through an opening in his red hat. The flexible dispenser may be rinsed out in soap and water. It is non-toxic, odorless, and shatterproof. Manufacturer is the Squeezit Corp., Morris Heights 53, N. Y.

Molding the blade of a hockey stick of reinforced plastic heralds an important stride forward in equipment for this popular sport. The new blades can withstand terrific abuse without splitting and yet will flex as required. From the standpoint of blade wear, they will outwear any wooden stick. Ash handles are molded directly into the reinforced plastic blades. The colored blades are made by Modern Molded Plastics Ltd., 327 St. James St., St. Johns, P. Q. Canada.



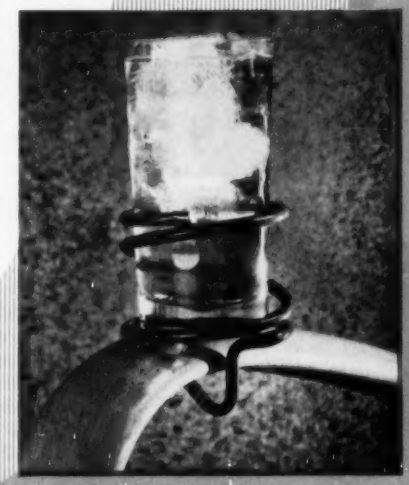
A thread box, molded of clear, transparent styrene, is cleverly designed to avoid cluttered drawers and tangled threads. Fourteen spools of thread, which slip over molded-in projections, can be stored in the box. When in use, the thread is pulled up to the desired length through a slot and snipped cleanly off by drawing it back against one of the small steel blades cemented into the cover. By Flambeau Plastics Corp., 501 7th St., Baraboo, Wis.



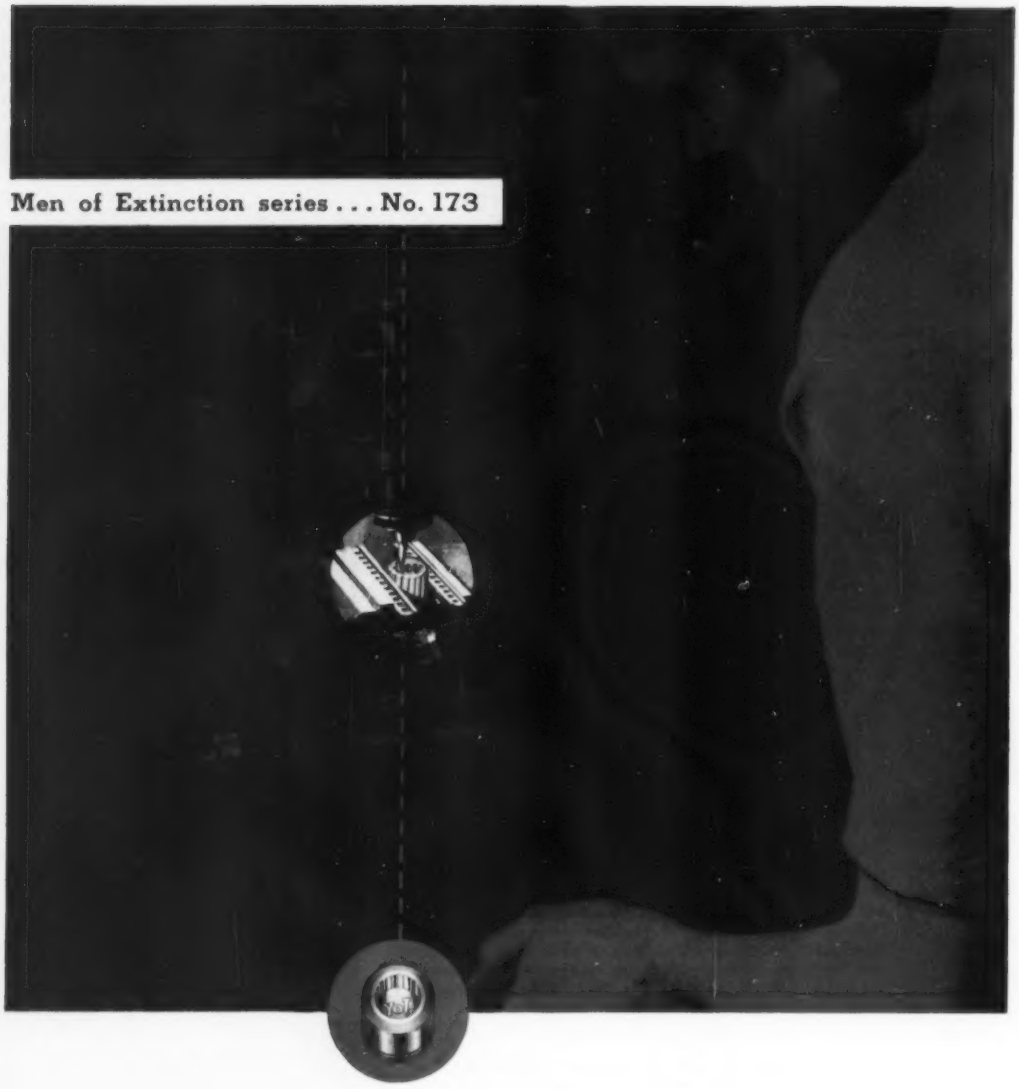
A transparent Tenite I cellulose acetate puzzleball tests the skill of the child puzzle fancier. The idea of the toy is to successively roll five differently sized marbles through the holes in each of three acetate partitions cemented to the inside of the hollow sphere. Partitions are extruded by Perfex Plastics, Inc., 4344 S. Wentworth Ave., Chicago 9. The sphere is molded by American Plastic Mfg. Co. for Kroll Teacher Toys, Inc., both of which are located at 2938-42 N. Halsted St., Chicago 14, Ill.

PRODUCTS

Spiral-shaped clip-on coaster that easily snaps on to chair arms, tables, or similar objects and holds drinking glasses securely, is made of Tenite I cellulose acetate tubing extruded over steel heavy wire and then formed. The acetate will not peel, chip, rust, or damage the finish of the furniture in any way. Tubing is extruded in red, green, yellow, or white by World Plastex, 1685 Boone St., Bronx 60, N.Y., and the coaster is distributed by the Kelcey Mfg. Co., 1687 McDonald Ave., Brooklyn 30, N. Y.



Especially designed to give the distinctive appearance of cut glass, a new butter-cheese dish, injection molded of styrene, is a handsome and practical addition to the housewares field. The high cover of the two-part dish is molded with a handy triangular projection that makes it easy to grip and remove. The dish is offered with crystal cover and various color bases by Rogers Plastic Corp., West Warren, Mass.



Nickodemus is one of a number of capable people whom we meet when prowling around the premises at MD&E. It is people like Nick who have a hand in making Hobbed Cavities by Midland. He qualifies as a man of extinction because he wants to monkey around triple-checking, thousandths, tens of thousandths, angles, contours, depths, etc. We're busy, and don't have time, but Nickodemus insists. We can't let him go because he owns the micrometer. Such is the situation at MD&E. Wherever sophisticated molders gather, the name Midland comes up when Hobbed Cavities are mentioned. Midland Hobbed Cavities, as you know, are proving every day that two things *are* alike . . . even 16 things . . . even 32 things, plastics units that is. If molding big or small plastics units in uniform multiple quantities, is your business, write Midland Die & Engraving Co., 1800 W. Berenice Ave., Chicago 13. Midland also makes plastics molds, die-cast molds, engraved dies, steel stamps, pantograph engravings.

PLASTICS ENGINEERING*

F. B. Stanley, Engineering Editor

Setting up a plant for

Custom Molding Reinforced Plastics

by Robert S. Morrison†

From the very beginnings of the reinforced plastics (then called "low pressure") industry there has been one widespread basic misconception. This arose from the apparent simplicity of the process and materials used. Anyone with a few dollars and an empty garage or basement could, it appeared, get into the business and make a go of it. This never was true—as many found to their sorrow—and is still not true today. The simplicity is only apparent—experience uncovers the pitfalls, most of which can be avoided or bridged only when adequate capital and trained personnel are available.

The author of the accompanying article looks at the reinforced plastics business from a realistic point of view. A successful pioneer in the industry, he writes out of experience. His purpose is not to discourage free enterprise; rather it is to present the facts so they can be faced squarely, misconceptions avoided, and new units of the industry built on a basis which will give the greatest chance of success.

PROBABLY no other field of economic endeavor seems to have a more brilliant future—and actually has a more difficult present—than custom molding of non-military reinforced plastics parts. Yet many individuals and established concerns want to get into this business.

This article will outline the capital, equipment, personnel, management, and sales effort needed to set up and operate a custom molding reinforced plastics plant, based on our experience and observations to date. Its purpose is to correct some of the misconceptions that exist about reinforced plastics production and to serve as a guide for those who, after considering all factors, still feel that they have the capital, ability, and health required for the job.

People have been led to believe wonderful things about fibrous glass when combined with polyesters and other resins. Resins and parallel glass strands molded into fish rod stock give terrific tensile, flexural, and impact strengths when tested in the proper directions, but resins and glass mat or preforms, as used in custom molding, do not produce anywhere near such strength properties. Reinforced plastics have many limitations, in addition to many advantages and superior properties. High cost is usually the main deterrent in civilian uses.

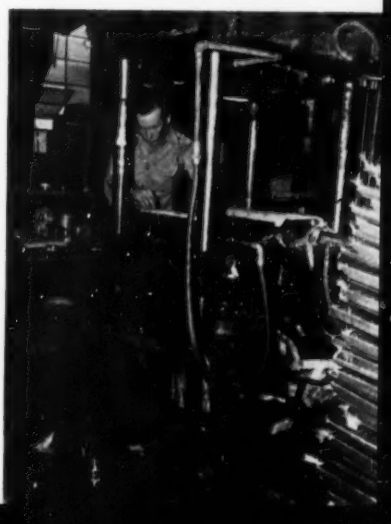
Reinforced plastics, instead of being considered as "wonder" materials which will replace huge quantities of steel, aluminum, etc., should be thought of as new materials. Applications for them must be discovered and someone must pay for the dies and experimental work to prove the superiority of the materials before large-scale production is justified. During the past two years of threatened and actual material shortages, many dies have been made to mold parts of reinforced plastics that never got into volume production because the scarce material became plentiful again and was either cheaper or better for the application than reinforced plastics. We have quite a collection of such dies in our plant, all paid for by customers, which never produced more than a few sample parts. We tried to guard against such applications but we still picked up too many.

Right now we have over $78,000 worth of dies under construction for customers, many of them for parts never before made, and we are not counting on immediate big volume from most of these dies. Product testing, market trial, and development take time.

Capital Required

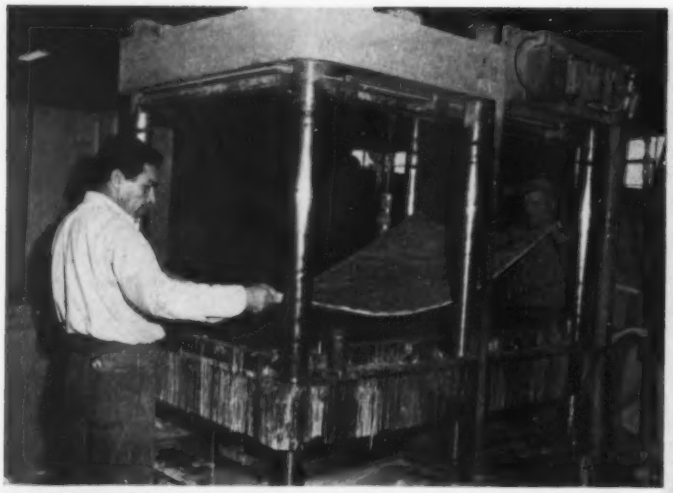
With these preliminary warnings, the best way to approach the sub-

Dissimilar parts can be made on one press if dies have same shut height



* Reg. U.S. Pat. Off.

† President, Molded Resin Fiber Co., Ashtabula, Ohio.



Three stages in the production of flat reinforced plastics sheet. Left: Two layers of 2½-oz. fibrous glass mat are placed in press die. Finished sheet size will be 36 in. wide by 72 in. long

A measured amount of filled polyester resin is poured onto the glass mat and spread. The press being used here is larger and more expensive than those discussed in the accompanying article

The cured sheet is removed by the use of rubber vacuum cups. Sheet is molded to exact size by telescoping dies machined to 0.002 in. clearance on length and width; finished sheet needs only a quick sanding to remove minor flash

All photos this article courtesy Plaskon Div., Libbey-Owens-Ford Glass Co.

ject of going into the business of custom molding of reinforced plastics is to list the capital required. As a starting point, a hypothetical plant will be considered which will be capable of mass production of items up to 40 in. wide by 60 in. long by 30 in. deep, in matched metal molds. An initial investment of at least $250,000 will not be too much; but don't let a big bank balance influence you to make unnecessary expenditures. It can dwindle rapidly! For our hypothetical plant, the following budget strikes a representative average of the amount of money you will need to get into this business:

Land—4 acres with water, gas, electricity, and sewer ..... $4,000.

Building—12,000 sq. ft. at $5.00 per sq. ft. ..... $60,000.

Most buildings available for rent are quite unsuitable; at least $20,000 will be spent putting all the needed facilities, partitions, power wiring, trenches, etc., into a rented building, and the result will usually prove unsatisfactory for future expansion

Compressed air system ... $1,500.

Seven large hydraulic presses (with plenty of stroke, daylight adjustment, power, rigidity, and speed) installed with controls, pumps, wiring, etc. ..... $70,000.

One standard 30-in. preform machine ..... $6,000.

One standard 48-in. preform machine ..... $8,000.

One preform machine for irregular shapes ..... $5,000.

Mixing equipment ..... $3,000.

Mat cutting equipment and cutting table ..... $1,000.

Maintenance equipment and tool room and supplies ..... $5,000.

Storage racks and material handling equipment ..... $3,000.

Die heating equipment .... $2,000.

Finishing equipment which could require a press brake, a punch press, sanders, drill presses, etc., will total at least ..... $8,000.

Office equipment, desks, and other furniture ..... $3,000.

Time clock, stationery, printed forms, etc. ..... $1,000.

Dust collecting system .... $2,000.

Lockers ..... $1,000.

Six months overhead during construction period ..... $18,000.

Traveling expenses, samples, advertising, and selling expenses before production ..... $12,000.

Six months overhead and developmental work getting first custom molding jobs into "overhead-carrying" production ..... $24,000.

Inventories, to be carried when in reasonable production; do not order too quickly ..... $30,000.

Cash reserve ..... $25,000.

It is assumed that accounts receivable will be offset by accounts payable when the plant is in normal operation. Nothing has been listed for prepaid insurance, since this is part of overhead. By renting a building, $250,000 would be adequate. Note that no funds have been allotted for dies. In custom molding the customer pays for the dies in advance of production. "Idea promoters" will try to get custom molders to pay for dies. If the customer does not have the money to pay for the dies, look out!

Flexible Presses

Presses in a custom molding plant should be flexible enough to handle a wide variety of jobs. Glass-reinforced plastics have their best uses in large and deep parts, and small parts can not be molded economically except in multiple cavity presses. Small presses limit the capacity and range of a custom molder and prevent taking on many excellent jobs. Since many small presses are in existence, the small parts business is usually more competitive. For a new venture, get large presses, or at least some large ones and some medium size ones.

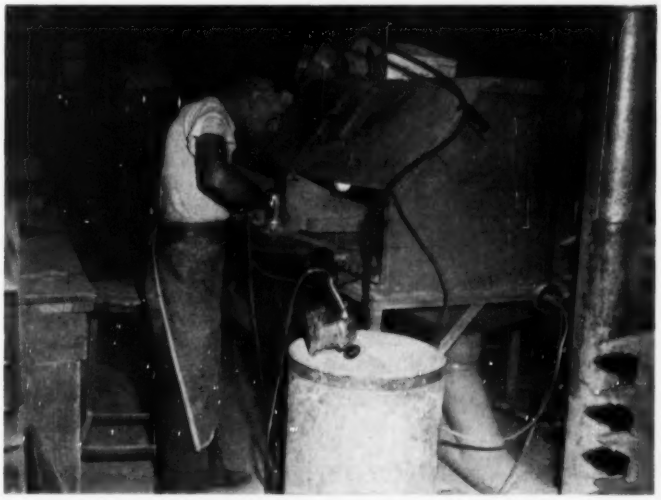
Most important in the reinforced plastics industry is to have *enough* presses. In custom molding work, new dies may remain in a press for a long time while you wait for test reports from your customer. Also, it will sometimes take weeks to start getting good production on a part. Unfortunately, trial and error is still standard operating procedure in reinforced plastics; in the meantime, the overhead rolls on while your top technical men are doing the trying and erroring.

In a seven-press operation you will have an average of two presses tied up without production at all times. In our plant we have 17 presses; sometimes as many as seven of them are tied up trying out new dies or waiting for die changes or customer approval. It costs about $50 to set the average pair of dies in a press for the first time, not counting press tie-up time. So dies are not changed if in a few days you expect to have everything ready to start steady production.

With three preform machines, you will sometimes not have enough preform capacity to keep six presses busy; at other times the preformer equipment may be idle, if you are running parts made from mat. A well equipped shop should have two types of preformers; one for

(*Continued on p. 114*)

Large housings which must have a special finish to match other parts on an accounting machine are sanded prior to applying the finish. Water-type dust collector is at right



Only among the large family of LAMINAC® polyester resins will you find special combinations of such a wide range of properties.

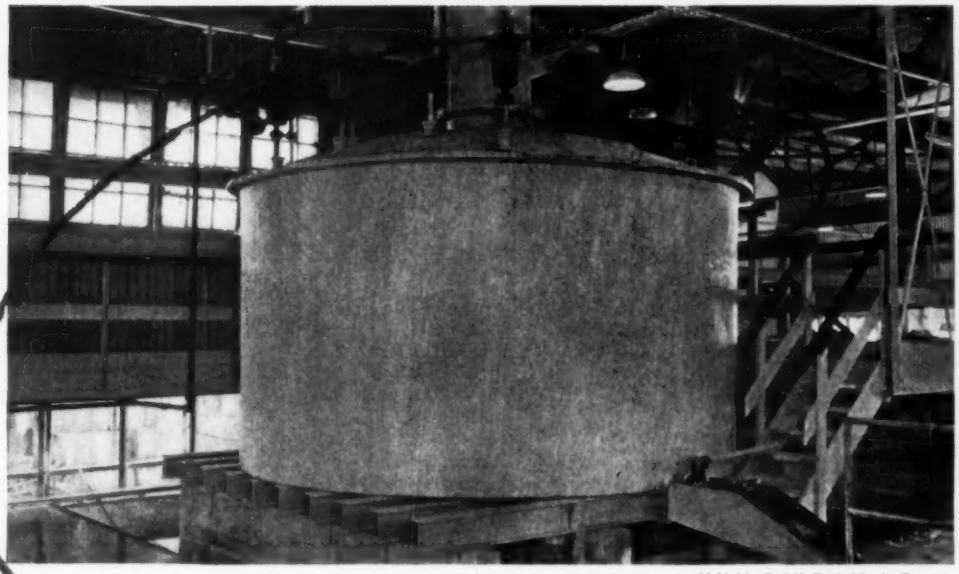
AMINAC® RESIN NO.	411315	4115	4116	4119	4123	4124	4128	4129	4134	4146	4150	4161	4202
VISCOSITY — LOW		√	√				√		√		√	√	
VISCOSITY — MEDIUM	√			√	√					√			
VISCOSITY — HIGH						√		√					√
GEL — QUICK	√	√		√							√		
GEL — SLOW			√		√	√	√	√	√	√		√	√
CURE AT ROOM TEMPERATURE	√	√	√	√	√	√	√	√	√	√	√	√	
HIGH MODULUS OF ELASTICITY				√			√	√		√			√
SEMI-FLEXIBLE												√	
FLEXIBLE									√				
CASTING PROPERTIES			√						√		√√	√	
GENERAL PURPOSE MOLDING		√			√		√						
HIGH HEAT DISTORTION[1]				√			√	√		√			
CHEMICAL RESISTANCE				√√			√	√					
ELECTRICAL PROPERTIES		√	√								√		
LIGHT STABILITY	√√												
HEAT RESISTANCE[2]				√			√	√		√			√
FIRE RESISTANCE										√√			

√ √ *outstanding*
(1) Range of 200°F to 240°F.
(2) Retention of physical properties after exposure to temperatures of 250°—300°F.

In addition, American Cyanamid now has several newly developed resins for specialized applications. Among these are powdered resin for preform binding, heat resistant formulations for temperatures of 450°F—500°F. and crystalline materials.

N. B. Don't miss the 8th Annual Technical and Management Conference of the Reinforced Plastics Division of the Society of the Plastics Industry. At the Shoreham Hotel, Washington, D. C., February 18–20.

The basic sales and technical problems facing the reinforced plastics industry at this crucial point in its development will be discussed in factual, documented detail by men you want to hear. Exhibits of hundreds of reinforced plastic products will be on display. *Make sure to attend.*



Molded by Carl N. Beetle Plastics Corp.

LAMINAC® 4119 TAMES BOILING CORROSION

one-piece unlined tank resists corrosion and product contamination!

Needed: An evaporator tank with exceptional chemical resistance to stand up under the corrosive attack of 4,000 gallons of aluminum sulphate liquor boiling at 240°F, acidity of pH 3. Former steel tanks, double-lined with lead and acid-resistant brick, were *still* subject to corrosion and consequent product contamination.

Chosen: LAMINAC polyester resin 4119, reinforced with Fiberglas* mat, for its outstanding chemical resistance, high heat distortion point, curing characteristics especially adapted to large shapes, high modulus—all at only 1¢ per pound premium.

Success: A corrosion-resistant tank that was easily molded—*linings unnecessary.* Cost, less than half the price of a conventional evaporator; weight, 2,200 lbs. —only one sixth as heavy as a metal tank. Easy to transport and erect. What an efficient and economical answer for various types of chemical processing equipment and containers!

Specifications: Height—8′; Diameter—14.5′; Side wall thickness—$\frac{3}{8}$″; Bottom thickness—$\frac{1}{2}$″; Cover thickness—$\frac{1}{4}$″; Stack diameter—30″; Stack height—22′.

*Trade-mark of Owens-Corning Fiberglas Corp.

✓ **REMEMBER . . .** Only in the large family of LAMINAC polyester resins will you find the molding, curing and service properties you need *in superior degree.* While chemical applications for this versatile group of polyester resins are just beginning to be developed, our staff of conveniently located Field Engineers will be glad to help you determine whether there is a LAMINAC Resin that can handle your corrosion problem.

LAMINAC ® polyester resins . . .

BEETLE ® urea-formaldehyde molding compounds . . .

MELMAC ® melamine-formaldehyde molding compounds . . .

Made under rigid controls to American Cyanamid's high standards of quality.

AMERICAN Cyanamid COMPANY

PLASTICS DEPARTMENT

32 Rockefeller Plaza, New York 20, N. Y.

Chicago • Dallas • Los Angeles

In Canada: North American Cyanamid Limited, Royal Bank Building, Toronto, Ontario, Canada

round and horizontally symmetrical parts, and one for rectangular or irregular parts or parts with special inserts. The important thing to remember is that poor preforms mean high rejects.

Management

The investor who is putting his own money into the business and plans to devote his time to its management should have no other businesses or jobs to occupy his time or attention. Getting established in this field requires undivided attention and tremendous hard work. For either owner-managers, or hired managers, the following personal requirements are musts:

1) Ability to grasp new things quickly.

2) High IQ and mechanical intelligence.

3) Previous business and sales experience, preferably not too easy or successful.

4) Good health and high interest in success which will offset the fatigue of long working hours and bitter disappointments and delays in getting into production.

5) An understanding and encouraging wife and family.

6) Some mechanical engineering or experience, with knowledge of die design and production.

Previous plastics experience or chemical background are purposely not listed. Techniques and problems in reinforced plastics are quite different than with other plastics. Production of low cost, high quality, high volume parts made of reinforced plastics is much more difficult than with any other type of plastics. An under estimation of the problems involved and attempts at solving these problems with standard plastics techniques can be very disastrous. An open mind without preconceived convictions, that can approach this field with considerable humility, is desirable.

Where can experienced managerial or technical personnel be hired for a reinforced plastics business? Practically all reinforced plastics custom molders are small owner-managed operations, with not more than two men in each plant knowing enough about management and technical problems to be able to set up and operate a new plant. These men, being financially interested in their present plants, are not likely to be attracted to new and unestablished companies. On the other hand, there are a large number of men who have tried in the past to establish their own plants and have run out of money or business. Some of these men have valuable experience and probably could be located by advertising or through glass and resin suppliers. Unfortunately, many of these men do not realize the necessity of proper equipment and excellent tooling because of the doctrine of cheap equipment and low cost tooling which has previously prevailed in this field.

Top management of any company that is going to be successful in this field must devote all of its time and attention to reinforced plastics. In other words, the company itself will have to concentrate 100% on reinforced plastics production. We believe that if big companies are to be successful in this field, they must establish a reinforced plastics department with a department manager at its head who has not only great ability and judgment, but unlimited authority and a budget sufficient to operate as an independent business. It is not the usual policy of big companies to write such blank checks, nor are their training programs and policies usually aimed at developing independent operators.

Big companies, however, might be more successful in developing proprietary items made of reinforced plastics than small companies; they have better advertising and sales organizations as well as established customer acceptance for their products. I would recommend that any company, large or small, seeking to develop a reinforced plastics proprietary item should turn the developmental and production problems over to an experienced custom molder first and get a year or so of market and product testing before

A number of different resin mixes in process. An overhead hood removes the styrene vapor and any dust present, and exhausts to the outside of the shop

Three dies for making the same reinforced plastics part—a fan blade—are mounted in a press on set of heating plates

setting up its own reinforced plastics production equipment.

Jack-of-all-Trades

The manager of a reinforced plastics business must be a jack-of-all-trades. He will have to do most of the selling—agents do not have the technical knowledge and plant contact needed—and he will have to make calls to get results. While our company gets hundreds of inquiries, practically all orders for custom molding require several visits to the customer's plant or facilities. It is very important to consider all the problems of physical and appearance requirements, design, and economic factors before taking on a job. The most serious blow to a new producer is to spend several months tooling up and planning for a new, long-run part which fails to be used in volume after the dies are completed. Even though the customer pays for the dies, time lost and development expense are terrific. So, the manager-salesman should be a skeptic, a detective looking for possible troubles, and should refuse to take on questionable applications.

In addition to doing the selling, hiring and training of personnel, getting the plant equipment set up, and operating and running the plant, a large part of the manager's time and attention will be taken up with die design, obtaining materials for them, and getting the machining done. Proper tooling and careful expediting of tool delivery is very important, and there are few toolmakers in the country experienced in making good, high production dies for reinforced plastics. Equipment for making large dies is scarce, and delivery promises frequently mean but little.

The theory that a manager should hire able men to take care of all production details, technical problems, sales and design work, and office functions, and then use his time to direct over-all policies, just won't work in this new reinforced plastics industry. Over a period of years he should work toward that ideal by selecting and training men, but in the early stages very close attention to all details, especially on design and production of new products, will be required of him.

Other key personnel should include a draftsman, a plant superintendent, a bookkeeper, an experimental and try-out man, and one or two all-around maintenance men who can install equipment and dies, take care of all plant maintenance, and finish and polish dies. Below this level, unskilled men and women can be hired for production work.

Reinforced plastics tray being removed from die in a 32½- by 36-in. press. The edge of this particular tray is further strengthened by molding-in a length of ¼-in. wire

Then there is the question of where to get business for such a plant. Some fields have been fairly well covered, such as trays and tote boxes, refrigerator parts, electrical parts, and military applications. At a recent meeting of several producers and a few material suppliers, a unanimous conclusion was reached that the way to establish a satisfactory reinforced plastics business is to pick a particular field or type of application for reinforced plastics and concentrate on it.

New uses for reinforced plastics constantly entice the operating men in this field, but no matter how simple and terrific the new idea appears, it may take months or even years to develop into profit, and far more managerial attention than expected. Don't get too many irons in the fire. Until you get some business established and some experience, it may be hard to decide on a specialized field.

High quality, low cost, and consistent production of reinforced plastics parts is quite difficult to attain. Working with two entirely dissimilar materials—fibrous glass and polyester resin—creates problems seldom encountered with homogenous molding materials. Reject rates are high, and costs are never as low as you can prove they should be. Furthermore, every new part has its own peculiar problems—usually problems not previously met.

Return on Investment

The probable rate of return on investment in a reinforced plastics custom molding plant is still a big question. I know of only one concern in the industry which deliberately started out with the proper equipment, trained its men carefully, and in any way approximates the standards set up in this article. It is too early to call the score on them. But, based on experience to date, it appears that a plant set up as outlined should earn 25% before income taxes on its investment after the second year.

In conclusion, I have tried to be realistic—not pessimistic—about reinforced plastics custom molding. What this industry needs is a group of properly equipped, managed, and financed custom molders who know what they can do and can not do, what should and should not be attempted in reinforced plastics, and who can deliver high quality, low cost, economically sound non-military high production parts, and still operate at a profit. Such a nucleus would help the entire industry to achieve the results so often dreamed about yet so infrequently reached to date.

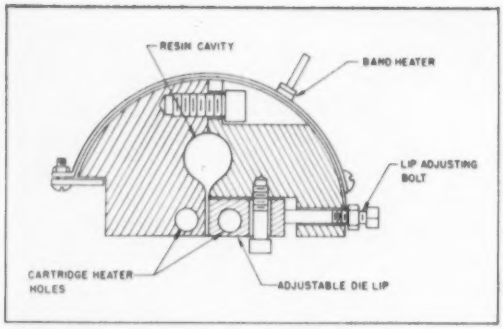


Fig. 1—Design for an end-feed die for extruding flat fluorothene film. Adjustable lip, heating control assure minimum variation in thickness

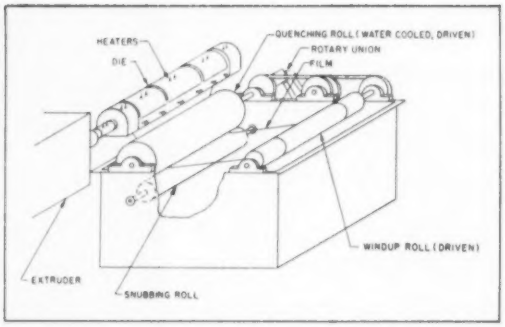


Fig. 2—Effective quenching is obtained by extruding the flat fluorothene film onto a polished roll through which cold water is circulated

Quenched Fluorothene Film

How film can be extruded and rapidly quenched to give good clarity and optimum flexibility, toughness, and impact resistance

by B. H. Maddock*

THE combination of chemical resistance and mechanical properties of polychlorotrifluoroethylene (fluorothene) resin makes it useful, in film form, for many packaging and protective applications involving the handling of highly corrosive chemicals. It is also non-flammable, highly impervious to transmission of air, oxygen, and water vapor, and shows excellent weathering and sunlight resistance. Straight die extrusion and quenching of flat film produces improvements in clarity, flexibility, crease resistance, and low temperature brittleness as compared with film produced by air-cooled tubular extrusion methods due primarily to reduced crystallinity resulting from the less effective quenching possible with the tubular methods.

It is therefore felt that flat film extrusion is the more desirable process. The cooling and wind-up system is also less complicated and could readily be adapted for lamination of extruded film to paper or fabrics.

A detailed investigation of the flat film extrusion process, as applied to polyethylene, has been described[1] by W. A. Haine and W. M. Land. Many of their techniques and some of their equipment were used in the present study.

Rapid Cooling Important

The importance of rapid cooling or quenching in the fabrication of film and other articles from fluorothene stems from its crystalline nature. While the amount of crystalline material in quenched film is on the order of 50%, the crystal and crystallite sizes are small compared to the wavelength of visible light, resulting in a high degree of clarity and optimum flexibility, toughness, and impact resistance. Quenched film is essentially free of spherulites.

Slow cooling allows time for the formation of spherulites of a size sufficiently large to cause scattering of light, resulting in a cloudy appearance, and the crystalline content of such a material may be as high as 80% in extreme cases. One effect on mechanical properties is illustrated by the fact that quenching may lower the brittle temperature (ASTM D746-44T) as much as 35° C. below that obtained with slowly cooled material. Those experienced in the

Table I—Typical Fluorothene Extrusion Conditions

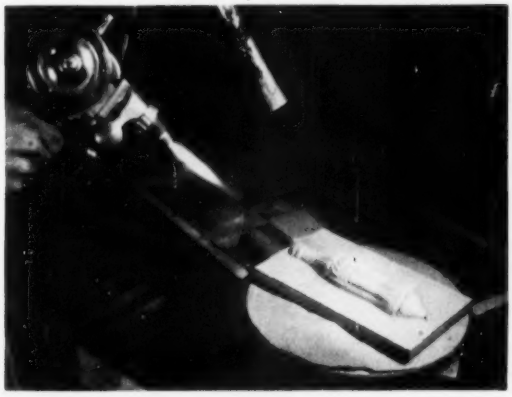
Screw:	Metering type, 2.5/1.0 overall compression ratio, heated with circulating oil at 300 to 350° F.
Screens:	40 and 80 mesh.
Throat:	Hot water cooled at 130 to 150° F.
Rear cylinder section:	450 to 480° F.
Front cylinder section:	500 to 530° F.
Die adapter:	520 to 540° F.
Die lips:	580 to 600° F.
Draw down distance (die to quenching roll):	2.0 to 3.0 inches.
Thickness reduction (die to finished film):	10/1 to 20/1

* Development Laboratories, Bakelite Co., Div. of Union Carbide and Carbon Corp., Bound Brook, N.J.

[1] Modern Plastics *29*, 109 (Feb. 1952).

molds made in minutes

by fast, low-cost metallizing process



For low-pressure, vacuum, slush and lay-up molding.

Metallizing, the spraying of molten metal, is now being used for the production of molds for low-pressure, vacuum, slush and lay-up processes, in a wide range of mold sizes—some lay-up types as much as 30 feet long. These metal molds are made quickly, at low cost; masters may be of metal, cloth, wood, plastic, glass, or even wax. Finest detail is retained and mold life is practically indefinite. Part spoilage, "break-out" and patching or other maintenance on lay-up molds are eliminated; improved heat transfer, better curing, assure void-free parts.

Metallizing gun building up metal mold directly on plaster master

Finished mold. Note fine detail. Spraying time 28 minutes.

MODERN PLASTICS *article describes method*

The article, "SPRAYED METAL MOLDS," by *Dr. Walter Brenner* and *Leopold Hase*, of Polytechnic Institute, which appeared in the September MODERN PLASTICS, described the process in detail. We will be happy to send you a reprint of this article on request. Use the handy coupon.

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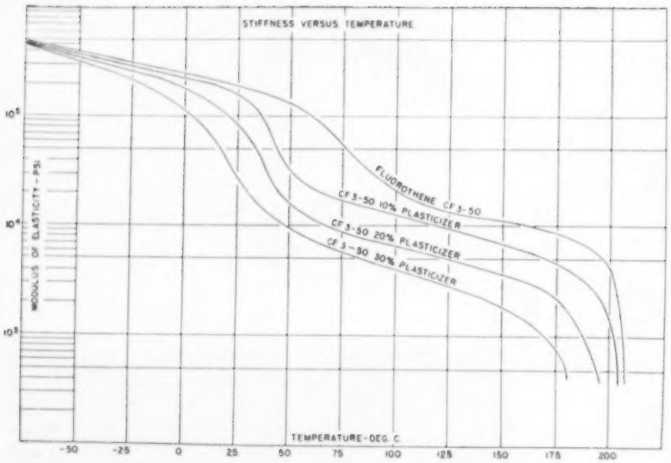


Fig. 3—Stress-temperature curves of fluorothene with and without plasticizer indicate that plasticization barely improves flexibility and crease resistance at low temperatures

extrusion of fluorothene as wire coating, rods, tubing, or other forms should have little difficulty in adapting their experience to the extrusion of flat films. As in all work with fluorothene, close temperature control is imperative at all stages of the process and particularly at the die lips. A uniform temperature across the width of the die will assure minimum variation in thickness, although a means of adjusting the die opening is desirable to provide additional control of this variable. A design for an end-feed die containing one adjustable lip and adequate heating facilities is shown in the drawing Fig. 1.

Typical extrusion conditions, using a 1.5 in. Modern Plastic extruder, are given in Table I.

Other Conditions

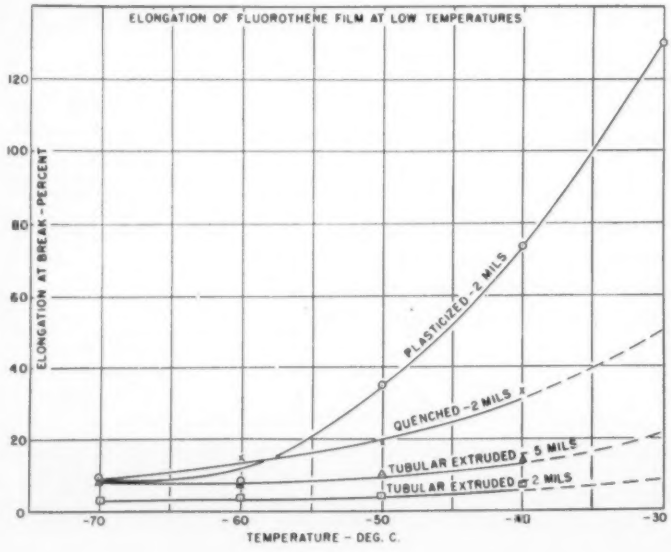
Conditions varying somewhat from the above may be required for other types of extruders or different screw designs, particularly if the temperature of the screw is not controlled by means of a heated liquid. In that case cylinder temperatures as much as 50 to 80° higher are often necessary and some difficulty with surging or nonuniformity of output rate may be experienced. The use of a controlled screw temperature is strongly recommended. In any event, the lowest possible extrusion temperatures should always be strived for to minimize the amount of molecular weight or viscosity reduction occurring during extrusion, since this tends to increase the rate of crystallization which might be reflected as increased brittleness and impaired high temperature aging properties. Some reduction in molecular weight during extrusion is normal, however, and should be expected.

Quenching may be accomplished, as previously mentioned, by extruding directly into water, but it has been found that fluorothene does not adhere to chilled metal surfaces and that effective quenching is obtained by extruding onto a polished roll through which cold water is circulated. This eliminates the necessity for a water bath and simplifies the wind-up mechanism.

Striking Difference

Such a quenching system is illustrated in Fig. 2. One striking difference between the extrusion behaviors of polyethylene and fluorothene is that the latter has very little hot strength or recovery as it leaves the die and therefore responds to the slightest drawing tension and can be "hot-stretched" at high speeds to give very thin films (0.1 to 0.2 mils) if desired. Immediately upon quenching it acquires a high strength (5000 p.s.i.), however, and variations in thickness may cause some wrinkling difficulties at the quenching or wind-up rolls. Temperature and thickness adjustments at the die should minimize this difficulty, but the point of contact with the quenching roll should be as close to the die as possible, both to minimize wrinkling and decrease in width. The rubber

Fig. 4—Elongation at break-temperature curves indicate superiority of quenched over tubular extruded film at all temperatures; plasticized film loses advantages at −50° C.


ELONGATION OF FLUOROTHENE FILM AT LOW TEMPERATURES
ELONGATION AT BREAK - PERCENT
PLASTICIZED - 2 MILS
QUENCHED - 2 MILS
TUBULAR EXTRUDED - 5 MILS
TUBULAR EXTRUDED - 2 MILS
TEMPERATURE - DEG. C.

ringing up sales

1400 Series Telephone manufactured by Stromberg-Carlson Company, Rochester, N. Y. Tenite housing and parts molded by Plastics Divisions, General Electric Company, Pittsfield, Mass.; Thermold Corporation, Manlius, N. Y.; Brilhart Plastics Corporation, Mineola, N. Y.; Ontario Plastics, Inc., Rochester, N. Y.; and The Watertown Manufacturing Co., Watertown, Conn.

Injection-molded Tenite provides tough, lustrous housing and parts for a new telephone base.

The shatterproof black Tenite housing and large number plate withstand hard knocks without chipping or peeling, lend a permanent pleasant feel and a lasting finish. Clear Tenite dust covers protect dial and hookswitch assemblies inside the base. Other, alternate Tenite parts — a disk and a dial blank — convert the face of the instrument for conventional dial or manual systems.

Superior housings of Tenite are also featured in such products as thermometers, fans, scales, and electric shavers. The durable plastic is available in limitless color effects and can be readily molded or extruded to design specifications.

For more information about the properties and many uses of Tenite, write EASTMAN CHEMICAL PRODUCTS, INC., Kingsport, Tennessee, Sales Representative for Tennessee Eastman Company, Division of Eastman Kodak Company.

TENITE

an Eastman plastic

● Information regarding Tenite is also obtainable through representatives located in Chicago, Cleveland, Dayton, Detroit, Houston, Leominster (Mass.), Los Angeles, New York, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, and Seattle; and elsewhere throughout the world from Eastman Kodak Company affiliates and distributors.

Table II—Properties of 1.5 mil Quenched Fluorothene Film at 23° C.

Tensile strength, p.s.i.	4500 - 6000
Elongation, %	100 - 125
Tear strength, grams/mil	140 - 170
Dielectric strength, short time, volts/mil	3700 - 4300
Water vapor transmission, grams sq. meter/day	Less than 2
Gas permeability cc/100 sq. in./day	
Air	Less than 2
Oxygen	2.0 - 5.0
Nitrogen	Less than 1
Carbon dioxide	5.0 - 10.0

snubbing roll should be shielded from heat radiated from the die, or separately cooled, to prevent embossing of the film. If a matte surface is desired to reduce blocking it is apparent, from Fig. 2, that it could be accomplished, on one side at least, by use of a matte-surface quenching roll.

Film which remains flexible and crease resistant at temperatures as low as −60° C. is desired for some applications. Attempts have been made to improve this property in tubular extruded film by plasticizing the base resin with low molecular weight liquid or grease-like fluorothene polymers. While a slight increase in room and elevated temperature flexibility is obtained, very little, if any, improvement is observed at low temperatures since the low molecular weight polymers tend to crystallize and lose their plasticizing effectiveness. This is illustrated by the stiffness-temperature curves of Fig. 3, in which it is also noted that the softening temperature is lowered about 1° C. for each percent of plasticizer added. Solvent swelling and extraction resistance are also impaired, since the low molecular weight polymers are

(*Continued on p. 209*)

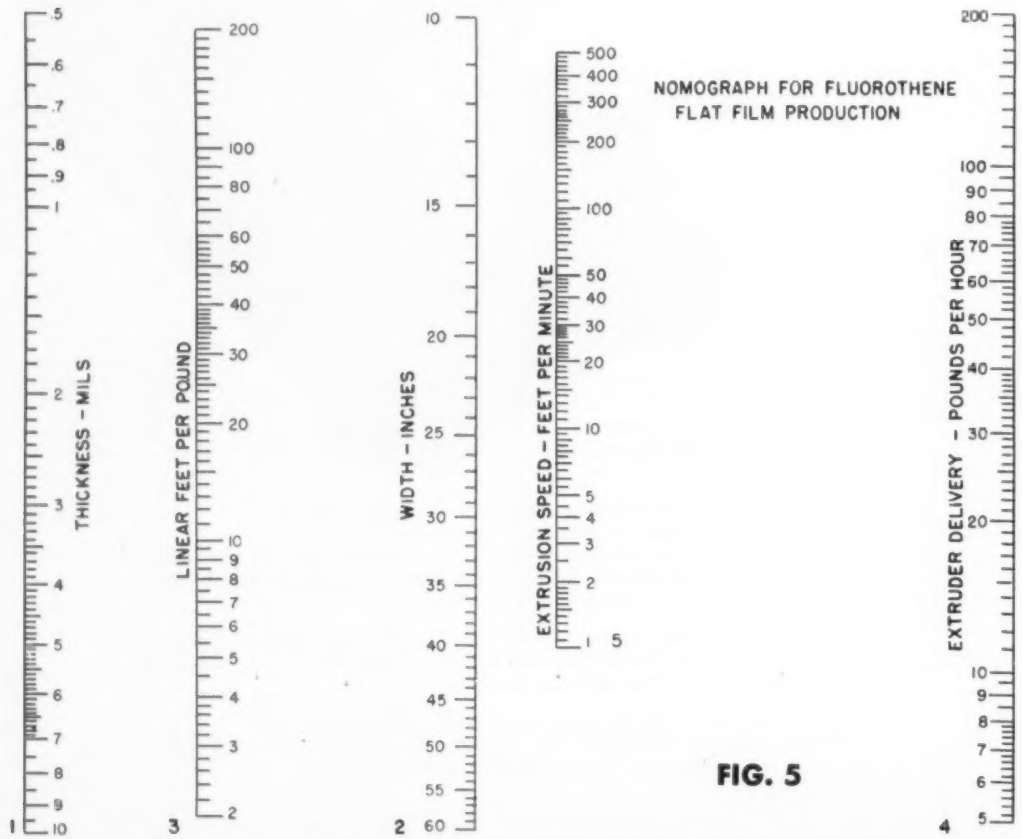


FIG. 5

PLACE STRAIGHT EDGE BETWEEN VALUES OF THICKNESS ON SCALE 1 AND WIDTH ON SCALE 2. READ LINEAR FEET PER POUND ON SCALE 3. PLACE STRAIGHT EDGE BETWEEN THIS VALUE ON SCALE 3 AND THE EXTRUDER DELIVERY RATE ON SCALE 4. READ EXTRUSION SPEED IN FEET PER MINUTE ON SCALE 5.

Forming Problems Overcome

Self-agitating feed attachment, plus vibratory control of press ram, automatically insures uniform feeding from hopper to die cavity

FOUR oil-hydraulic presses equipped with special attachments have eliminated a major production problem at the plant of U. S. Gasket Co., Camden, N.J., and have simultaneously brought about other outstanding gains. This manufacturer of such items as radio tube sockets and washer-type gaskets makes most of its products from Du Pont's Teflon.

Until the adoption of Multipress, it was exceptionally difficult to feed the raw material to the molding dies, because of a tendency of the loose granular particles to cling together, in a non-fluid mass. Multipress, made by The Denison Engineering Co., Columbus, Ohio, solved this problem with a shuttle-type, self-agitating feed attachment, which automatically feeds the material from a hopper to the die cavity.

When the feeding box has reached the final position over the die cavity, vibratory control causes the hydraulically operated ram to make a series of rapid repeat strokes, which further shakes the material into the die. As the ram retracts from this phase of the operation, the feeding box wipes the die cleanly and evenly, making it ready for the actual compacting process. The press ram then descends and exerts the pre-set pressure on the die fill. As it returns to the "up" position, a bottom or ejection ram rises automatically and lifts the compacted part to the level of the surface plate where it can be pushed into a tote box by the next approach of the feed device.

Production Speed Raised

In addition to overcoming the forming problem, the smooth, oil-hydraulic operation and fully adjustable ram action of Multipress has been instrumental in cutting production costs and raising production speeds. The force applied by the hydraulic ram is an instantaneous build-up of energy that becomes the working effort *only* when resistance is met. This particular feature has cut down the percentage of production-loss due to loose compactions, because the pressure is not applied by the ram until it touches the material being processed. The compacting is done with automatically uniform results—an absolute necessity, since most parts manufactured at U. S. Gasket must pass strict micrometer tests for close tolerance requirements.

Quick Tool Changing

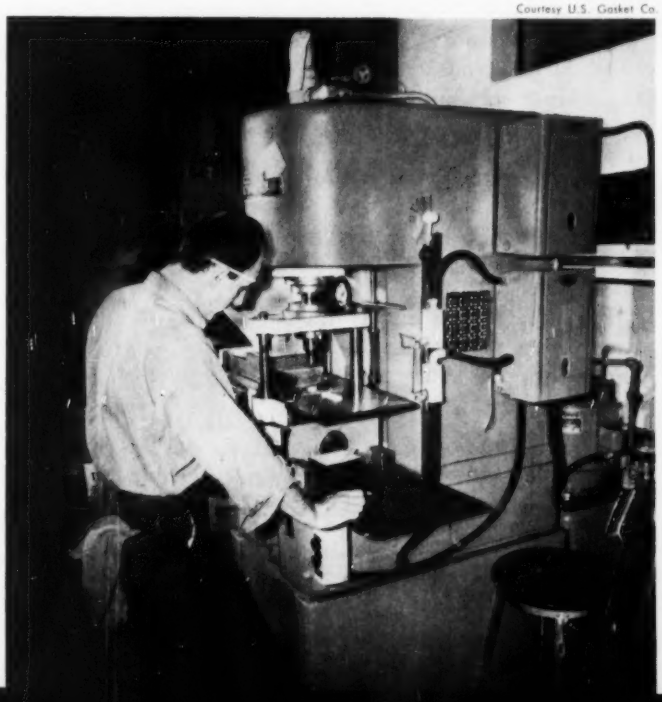
Further advantages of the Multipress installations at U. S. Gasket are quick tool changing and easy ram stroke adjustment. The company uses more than 1000 different dies and is able to switch any of the four Multipresses from one group of short run jobs to another with minimum loss of production time. Both the height and depth of the ram stroke can be regulated by a single adjustment of stop collars. Any distance requirement within the ram's maximum stroke length can be attained in this manner.

All four of the presses at U. S. Gasket are tooled with a bottom ram which applies upward pressure, giving equal pressure on the top and bottom of the material being processed. This "double-end" action provides for complete press control, which has produced much more uniform results than attained on the type of press formerly used.

All four Multipress units are operated by unskilled employees who like the easy operation and simplicity. The element of safety is high, since it is not necessary for the worker to put his hands within the area of the moving ram.

Material with particles which tend to cling together in a non-fluid mass is fed uniformly to the forming die by a shuttle-type, self-agitating attachment on the press

Courtesy U.S. Gasket Co.



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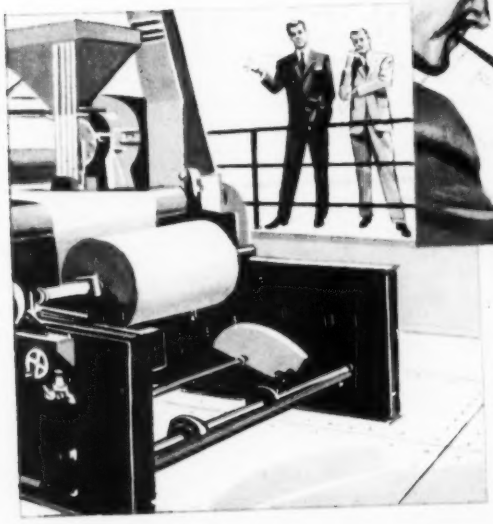
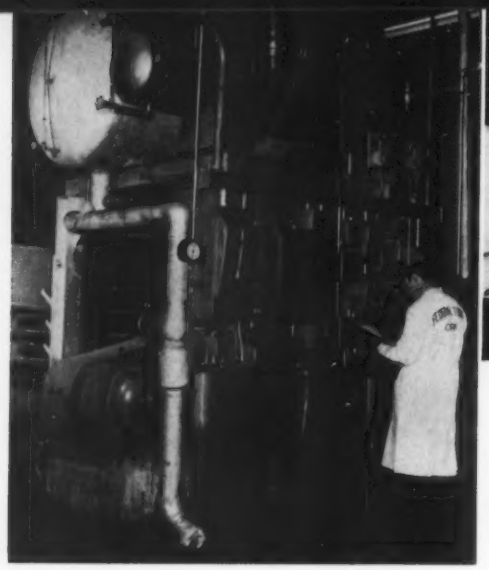


With timers on injection machines mounted on jacks, defective timers can be immediately replaced, greatly reducing costly shut-down periods



With its own water-pumping and refrigeration system, injection molding plant always has water at constant temperature and pressure

Details that Count

How an injection molding plant has increased efficiency by installing its own water supply, improving its electrical system, adopting automatic mold thermostats and centralizing controls on single panels

WHAT steps can an injection molding plant take to pare equipment down-time to a minimum, ease the load on supervisory personnel, and offset some of the conditions which may lead to uneven press cycles, inefficient machine operation, and excessive scrap losses?

Federal Tool Corp., Chicago, Ill., is among the molding plants which have given a great deal of thought to these questions. Operating 17 injection machines of from 8- to 60-oz. capacity and three extruders from 1½ to 3½ in. in size, Federal at present is running on a three-shift basis, combining custom and proprietary molding.

As pointed out by Ray Olson, plant manager, variations in water pressure and temperature once constituted a major problem at Federal. When the plant water supply was piped directly from the city water system, water temperatures varied widely at different seasons of the year, causing fluctuations in molding cycles; pressures, affected by lawn sprinkling and other domestic water uses, were never constant.

Water Cooling

Federal overcame this situation by installing its own water pumping and refrigeration system, which cools and recirculates the water delivered to the presses, extruders, air compressors, etc. By means of this arrangement, the plant water supply is held at a constant 60-lb. pressure and 55° temperature, enabling the plant to maintain uniform molding cycles over a 24-hour day, 365 days per year. Federal has found that it costs the company less to refrigerate and recirculate its own water than to buy regular city water service and dispose of the water after using it only once. This is over and above the substantial savings resulting from unvarying press cycles.

The 60-lb. pressure maintained in the water system makes it possible to get effective cooling circulation even through restricted water passages. Today's faster molding cycles make such provisions for cooling increasingly important. Typical parts which in previous years might have been produced on a leisurely 100-shot-per-hour cycle may now be molded at a rate of 200 or more shots per hour.

Timer Troubles Reduced

Recognizing that electrical difficulties frequently lead to costly shutdowns and loss of production, Federal has developed a method of holding such troubles to a minimum. Since a large percentage of molding plant electrical problems trace back to timer failure—with each press

having at least four timers where trouble might occur—Federal now installs the electrical connections of all timers on jacks so that they can be immediately disconnected and another timer snapped in place. With a reserve supply of timers always available, changeovers can be made in a matter of minutes, without losing valuable press time.

The entire subject of mold temperature control receives close attention by Federal operating man. Recent developments in plastics materials have increased the importance of this problem. The new copolymer materials, for example, require the addition of heat to the mold at controlled temperatures for maximum impact characteristics and surface gloss in the finished parts. Meanwhile, keener competition puts an ever greater premium on faster molding cycles, consistent with quality production. To meet such conditions, the company recently equipped one of its 8-oz. Reed-Prentice machines, and is planning to equip all its machines, with a new, specially designed automatic Thermolator mold temperature control unit made by Industrial Mfg. Co., Indianapolis, Ind.

Close Temperature Control

In controlling mold temperatures, Federal usually holds to a plus or minus variation of not more than 3°, although certain molds require an even narrower range for most efficient operation. With the new automatic unit, first of its type to be installed in a molding plant, operation is facilitated because the supervisor needs to set only one dial for each half of the mold when starting up the press. The unit automatically adds or drains heat at the dial setting, according to the requirement of the mold in operation. Large, 6-in. dial thermometers on the panel mounted controls are calibrated for easy reading from the operator's station.

The switch from heating to cooling, or vice versa, is made automatically as conditions require, without operator attention. In the customary installation, the operator cannot see the thermometer in the back of the press unless he remembers to go behind the press from time to time to check temperatures; consequently, there may be a delay of several hours in switching from heating to cooling. In the new Federal installation, two thermostatic controls in each line meet this situation automatically.

Water level in the accumulator tanks is automatically maintained with no temperature disturbance even if a faulty hose connection is present. Auxiliary heat input of high wattage is provided for rapid temperature raising, with an automatic cut-out when the desired temperature is reached, eliminating the "over-run" inherent in heat input applications.

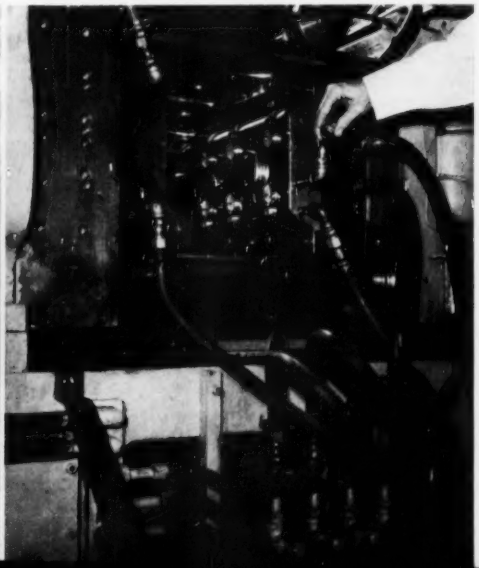
A system of panel mounting of controls and gages for injection machines is followed throughout. "Locating all the controls on a single panel," states Mr. Olson, "enables us to lessen the load on supervision. We have assembled all the controls (except pressure) in a single control panel conveniently situated for checking, adjustment, and maintenance. With expanding plant capacity, we have thus solved a good part of the problem of providing adequate personnel by eliminating unnecessary work in checking and adjusting controls, and at the same time improved the efficiency of our operation."

Panel mounting of controls, a practice now being followed by a number of press manufacturers, avoids locating the controls in press recesses where checking and adjustment may be inconvenient.

The mold temperature control unit itself is located behind the control panel rather than in the usual position behind the press. This arrangement, Federal points out, provides more operator space between presses, removing the temperature control equipment from the traffic pattern. Quick-change couplings made by Hanson Mfg. Co., Cleveland, Ohio, enable mold hook-ups for water circulation to be made without delay.

Panel mounting of all machine controls, except pressure, is a time-saving feature of new automatic mold temperature control installation

Another time-saving device in a molding plant is the use of quick-change couplings for making mold hook-ups for water circulation



Abstracts of papers presented at the Ninth S. P. E. Technical Conference

THEME of the Ninth Annual Technical Conference of the Society of the Plastics Engineers, Inc., held at the Hotel Statler, Boston, January 21 through 23, 1953, was: "Plastics—Engineered for Tomorrow." Engineers from all over the United States and Canada as well as many from South America, Great Britain, and other European countries were in attendance.

Available abstracts of papers given at this conference follow:

Techniques of Injection and Compression Molding Polytrifluoroethylene

C. R. Giannota, M. W. Kellogg Co.

This paper included a brief discussion of the basic polymers, including the forms and grades in which they are presently being produced by M. W. Kellogg Co., Jersey City, N. J., under the trade name Kel-F. Also given was an explanation of the No Strength Temperature test for control of the polymer and the fabricated part; a brief description of physical properties, including electrical, chemical, and thermal; and a thorough discussion of the conditions required for molding and handling of molding powder, with brief remarks concerning mold design. The control of the molding process including temperature, cycle, and mold control; the injection molding process with some recommended press and operating conditions and typical cycles and temperatures; the compression, transfer, and plunger molding process, including heating and cooling of the mold and variation in the process to obtain efficient cycles, were also discussed.

Vinyl Compounding

M. S. Greenhalgh, General Electric Co.

During the past few years there has been considerable discussion of vinyl compounds, particularly in connection with the advent of powder mixing. Several resin manufacturers have gone so far as to publish brochures with their recommendations as to the correct technique to follow in extruding vinyl compounds made from powder mix. These publications, if not in agreement, have had a tendency to make for a more open discussion of the extrusion problem which has been beneficial to all concerned.

In 1949, the author prepared a paper on extrusion and attempted to indicate the need for more efficient processing equipment. Several basic variables were pointed out at that time, and it is interesting to compare these variables from the standpoint of present progress.

In the meantime, new types of materials, such as monochlorotrifluoroethylene, rigid vinyls, elastomeric plasticized vinyls, and so forth, have presented new problems to the industry. This is particularly true of monochlorotrifluoroethylene, the use of which has necessitated somewhat new techniques in extruding.

Mold Castings

Gregory J. Azarian, American Brake Shoe Co.

A brief resume of the technical phase of precision castings was given, including the metal analyses being cast and what has been learned concerning advantages and disadvantages of different analyses, heat treatment, polish, etc.

Discussion covered the advantages of iron and alloyed iron castings, as to price, delivery, weldability, and casting consistency, as well as future prospects for precision iron and alloyed iron molds and metals being considered.

Organic Plastic and Glass Bonded Mica

J. Harry DuBois, Mycalex Corp. of America.

Glass-bonded mica is used extensively to gain high temperature resistance, dimensional stability, low loss factor, high arc resistance, precision dimensional control, and minimum differential expansion with inserts. Newly developed glass-bonded synthetic mica permits elevation of temperature stability from 650 to 900° F., with good electrical properties in this range.

Experimental compounds of trifluorochloroethylene-bonded synthetic mica and of tetrafluoroethylene-bonded synthetic mica point the way toward important materials of the future.

The Metallization of Plastics

Dr. Harold Narcus, Electrochemical Industries.

This paper outlined the advantages derived from the deposition of various metals on organic plastics, based on comparisons made between unplated and plated plastics. Experiments reveal a marked increase in tensile, impact, and flexural strength for most synthetic resins, when plated, as compared with the values for the same resins, unplated. An appreciable increase in resistance to distortion under heat and a decrease in water absorption is obtained by complete envelopment of the plastic article in a metallic coating. The most important advantage of plating on plastics is the greater corrosion resistance of a metallic deposit when it is applied to a plastic base, because no galvanic couples are formed. The paper pointed out that, basically, the main purposes for metallizing a plastic are: 1) to render it a suitable substitute for critical and strategic metals: 2) to produce a product which has the inherent properties of the plastic in addition to the desired properties of the deposited metal; and 3) to utilize certain "scrap" plastics materials which otherwise would have to be reprocessed to be used.

Also discussed were the various successful methods for the metallization of plastics with particular emphasis on the proper selection of a method for a particular application.

(*Continued on p. 210*)

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Metallic Soaps as Gelling Agents for Plastigels

by K. Parker† and L. Tritsch†

The use of metallic soaps in plastigels takes advantage not only of their efficiency as gelling agents, but also of their stabilizing properties. The best metallic soaps found to date are sodium stearate, calcium stearate, aluminum distearate, lithium stearate, lithium hydroxystearate, and magnesium stearate. Sodium stearate is of particular interest, because for plastigels of moderate stiffness, it can be incorporated in powder form, thereby eliminating the necessity of forming a pre-gel.

PLASTIGELS (1, 2)[1] are essentially vinyl plastisols that have been converted to semi-plastic or putty-like materials by the addition of a gelling agent. They can be molded, extruded, or calendered under low pressures without heat. Conversion to the finished product is accomplished by a short heating cycle at a temperature of about 350° F.

A booklet on plastigels (3) gives data on compositions containing Bentone 34 as the gelling agent. Aluminum laurate, aluminum di-2-ethylhexanoate (octoate), aluminum stearate, magnesium stearate, and Napalm are also mentioned as useful gelling agents, but no details are given as to the relative effectiveness of these soaps. Because of the demand for technical information on the use of metallic soaps in plastigels, a study was made of a variety of these gelling agents. Two dispersion resins, Geon 121 and Vinylite QYNV, were used in a standard formulation containing 60 parts DOP (di-2-ethylhexyl phthalate) for each 100 parts of vinyl resin.

Metallic soaps such as aluminum, sodium, calcium, magnesium, and lithium stearates are not only efficient gelling agents, but also stabilizers against heat degradation. From 5 to 10 parts of soap convert a fluid plastisol to a semi-solid plastic, which can be molded and extruded readily and which retains its shape and pattern perfectly during the fusion process. Plastigels can be adapted to most processing operations since relatively small changes in formulation produce a wide range of consistencies.

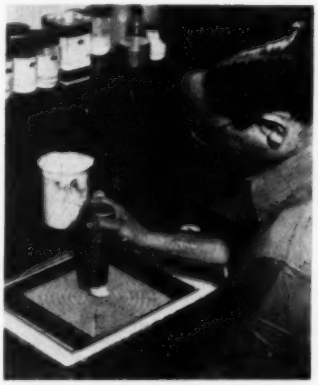


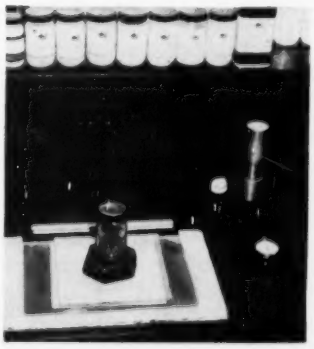
Fig. 1—Gardner Putty Consistometer. A known volume of plastigel from the syringe is placed on the glass plate before test

Preliminary experiments showed that while addition of the metallic soap, as such, produced some gelation, maximum gelling efficiency was achieved by heating the metallic soap in a portion of the plasticizer until a clear viscous solution (containing 25% soap) was obtained. Upon cooling, grease-like gels were formed. These pre-gels varied from stiff pastes to soft jellies, depending upon the metallic soap used.

Equipment and Procedures

Initially, two types of mixers were employed in the preparation of plastigels, a double arm (W-P) mixer and a three-roll paint mill. The vinyl resin, plasticizer, and pre-gel were weighed out in a

Fig. 2—Gardner Putty Consistometer. The plastigel is subjected to increasing loads and its diameter of spread between glass plates is measured



* Reg. U.S. Pat. Off.
† Witco Chemical Company.
[1] Numbers in parentheses link to references at end of article.

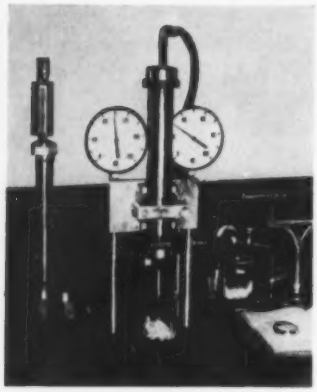


Fig. 3—Severs Extrusion Rheometer. The flow rate of the plastigel through the orifice is determined under various pressures

beaker and mixed thoroughly with a spatula before they were ground in the mill or mixer. It was found in every case that the three-roll mill gave a considerably stiffer material in two passes than the mixer after 1 hr. of mixing. All the plastigels were thus prepared by milling.

The consistency of the plastigels was measured with two types of instruments. A so-called putty consistometer (4, 5) was constructed in the laboratory (Fig. 1). It consists of a syringe that delivers a constant volume of material in the shape of a cylinder with a diameter of 3.4 cm. and a height of 2.25 cm. The stiffness of a plastigel is determined by compressing this cylinder between glass plates under various weights (Fig. 2), the diameter of spread being measured after allowing the load to act for 1 minute. The load is increased in steps from 1 kg. to 10 kg.

The other instrument used in this investigation was a Severs Extrusion Rheometer (5), which is essentially a constant shear viscometer. This apparatus (Fig. 3) is designed to measure shear rate under varying shear stress, or the change in rate of flow with increasing pressure. The plastigel is forced through an orifice (diameter 0.591 cm., length 5.08 cm.) under air pressure and the volume of material extruded per second under various pressure drops through the orifice is determined. Pressure drop through the orifice is defined as the difference between head pressure in reservoir and atmospheric pressure.

Both instruments measure flow properties under pressure; however, the consistometer simulates conditions encountered in molding operations, while the rheometer duplicates the extrusion process.

Most of the materials studied in this work were tested on the consistometer, since the latter provides a faster and more convenient method of evaluating the relative stiffness of a great number of samples. Approximately 75 plastigel compositions were prepared. Measurements were taken about 1 hr. after mixing, and after 1, 2, and 7 days, and in some cases after 1 month.

Tests with Consistometer

The metallic soaps investigated were barium, cadmium, calcium, lead, lithium, magnesium, sodium, and strontium stearates, as well as a wide variety of aluminum soaps, including special grease grade aluminum stearates. Barium and cadmium stearates were found to be insoluble or to give only slight gelling in DOP and were therefore not further tested. However, the stiffness of the pre-gel was not always indicative of the consistency of the final composition.

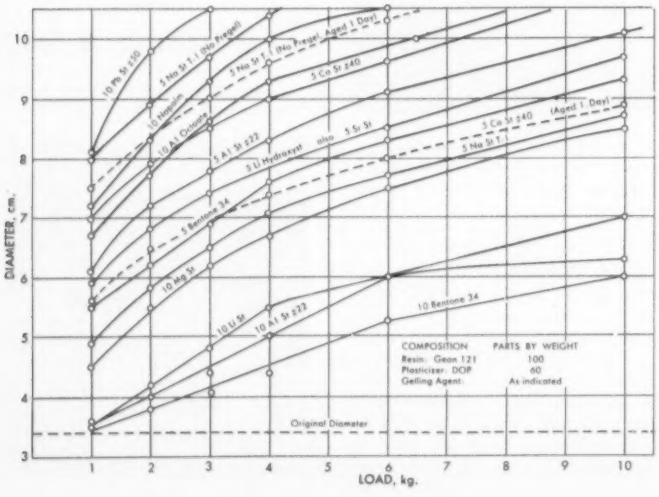
The following Witco aluminum soaps were evaluated with Vinylite QYNV resin:

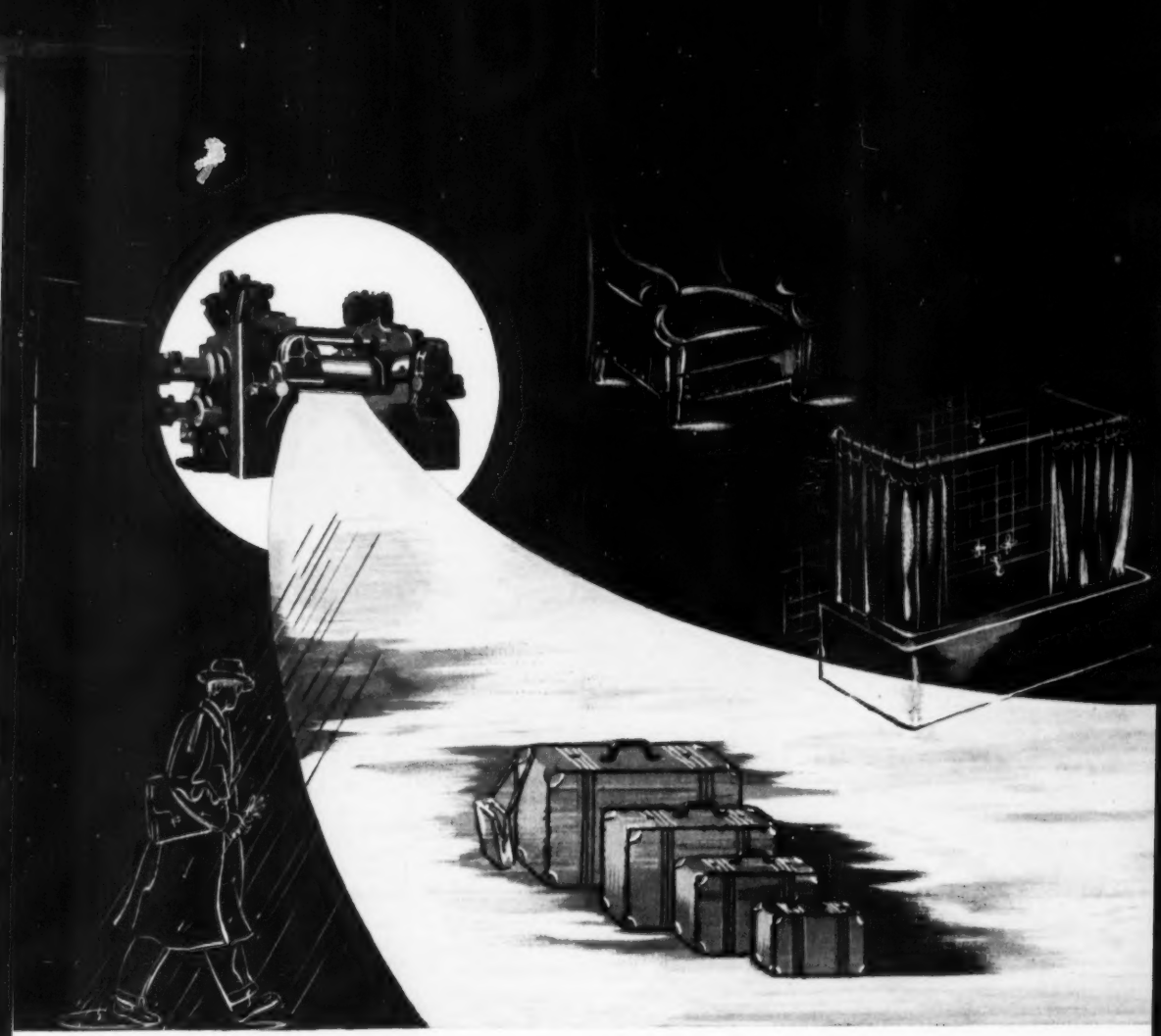
Aluminum Stearate #132 (tristearate)
Aluminum Stearate #18 (distearate)
Aluminum Stearate #22 (distearate)
Aluminum Stearate #36 (monostearate)
Aluminum Stearate #22-G (grease grade)
Aluminum Laurate
Aluminum Palmitate
Aluminum Hydroxystearate
Aluminum Octoate
Aluminum Oleate
Napalm
Aluminum Naphthenate

Values obtained for this series with the Gardner Putty Consistometer are shown graphically in Fig. 4. Aluminum Stearate #22, a distearate, exhibited the greatest gelling action of all the aluminum soaps tested in this series. This is in agreement with the behavior of aluminum soaps in mineral oils and solvents, in which the di-soap is always found to yield stiffer gels than the mono- or tri-soap. Special aluminum stearates that are used in the manufacture of greases, were found to offer no advantages over regular aluminum stearate in plastigels. Aluminum naphthenate, the only metallic soap tested which produced a gel in the plasticizer at room temperature, exhibited approximately equal gelling efficiency when incorporated either in powder form or as a pre-gel.

Consistometer results obtained with a variety of metallic soaps in Geon 121 are shown in Fig. 5. The

Fig. 4—Gardner Putty Consistometer tests on plastigels made with aluminum soaps





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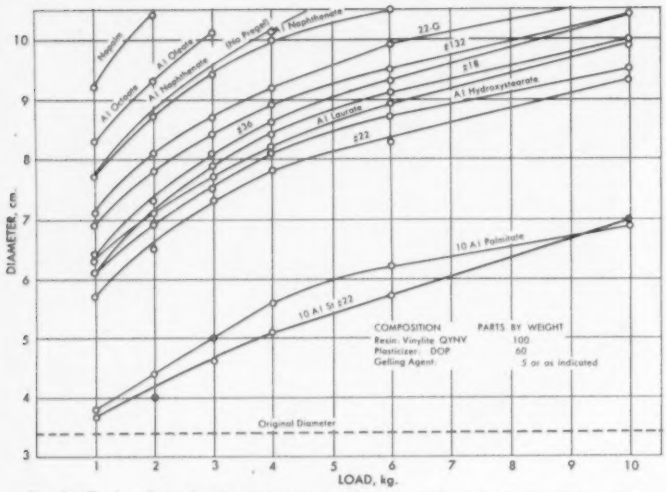
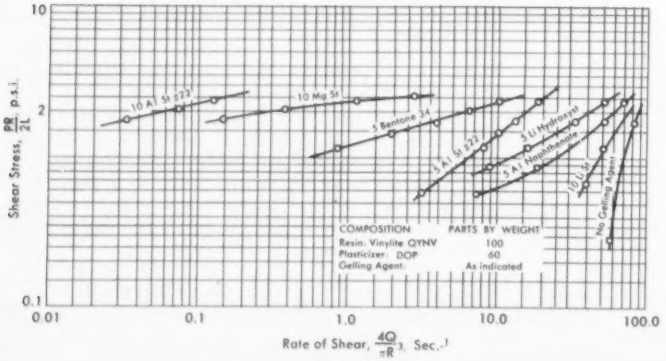


Fig. 5—Gardner Putty Consistometer tests on plastigels made with various gelling agents

best gelling agents were sodium stearate, calcium stearate, lithium hydroxystearate, and magnesium, strontium, and lithium stearates. Since lithium hydroxystearate was originally developed as a gelling agent for synthetic greases, employing diesters rather than mineral oils as the fluid component, its high gelling efficiency in DOP was not unexpected. Witco Sodium Stearate T-1 yielded moderately stiff plastigels in Geon 121 when incorporated as a powder but even greater gelling was obtained when a pre-gel was employed. Sodium stearate was found to be not only the most efficient but also the most economical gelling agent for this resin when incorporated in the form of a pre-gel. Plastigels containing calcium stearate, though initially softer, stiffened enough after aging 1 day to be comparable to plastigels obtained with a pre-gelled sodium stearate.

Plots of the diameter of spread versus load generally were smooth curves up to 10 kg., the maximum load tested, with a significant decrease in slope occurring generally between loads of 3 and 4 kg. Only the experimental data obtained from the initial tests, run within 1 hr. after milling, are presented since with the exception of sodium stearate when incorporated as powder and calcium stearate, no significant changes in consistency were found on aging.

Fig. 6—Effect of gelling agent on flow properties of plastigels, as measured with the Severs Extrusion Rheometer



Tests with Rheometer

Since plastigels belong to the category of plastic solids they exhibit non-Newtonian flow properties. For a Newtonian liquid a plot of shear stress versus shear rate is linear and passes through the origin. Thus, in Newtonian flow the ratio of shear stress to shear rate is constant and an infinitesimal stress results in flow. For plastic solids, however, there is a definite yield value, which may be defined as the minimum shear stress necessary to produce flow. If a stress greater than this minimum value is applied the material will flow, but the shear rate will not be directly proportional to the shear stress.

In order to determine the flow properties of some of the more promising compositions under various shear stresses the Severs Extrusion Rheometer was employed. From the dimensions of the instrument, the pressure drop through the orifice, and the volumetric flow rate, a fundamental analysis of flow characteristics is obtained from Poiseuille's Law (6):

$$Q = \frac{\pi P R^4}{8L} \frac{1}{\eta_i}$$

which can be written

$$\frac{4Q}{\pi R^3} = \frac{1}{\eta_i} \frac{PR}{2L}$$

where

Q = volumetric flow rate
P = pressure drop through the orifice
L = length of the orifice
R = radius of the orifice
$4Q/\pi R^3$ = rate of shear at the wall for a Newtonian liquid
$PR/2L$ = shear stress at the wall, and
η_i = coefficient of viscosity

A relative viscosity coefficient η_i can thus be obtained as the ratio of $PR/2L$ to $4Q/\pi R^3$, and the apparent viscosity can be calculated by the method of Rabinowitsch (7). Blott and Samuel (9) have used the same data to calculate absolute viscosities by use of Mooney's (10) equation.

The plot of shear stress versus shear rate, in the absence of thixotropic breakdown, entrance, and exit effects, is independent of the dimensions of the orifice. Since the nature of plastigels is such that

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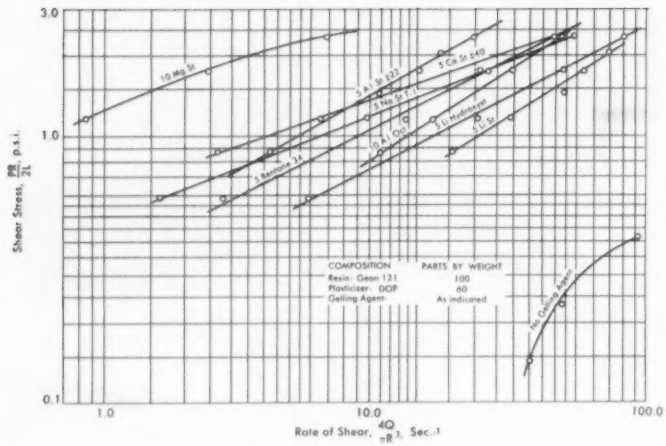


Fig. 7—Effect of gelling agent on flow properties of plastigels, as measured with the Severs Extrusion Rheometer

thixotropic breakdown does occur, the experimental curves shown are dependent upon the dimensions of the orifice used. One experimental composition was extruded through orifices of different diameters but of the same length and, as expected, the smaller orifice yielded greater shear rates for given shear stresses than the orifice of larger diameter. To minimize this breakdown the largest available orifice for the instrument was employed here.

Experimental curves of a series of plastigels containing Vinylite QYNV and Geon 121 are shown in Figs. 6 and 7 respectively; log-log paper was used in order to cover a wider range of values. Comparison of the curves at equal shear stresses reveal sodium, calcium, and aluminum stearate again as very effective gelling agents. For comparison, the same test results were plotted as pressure applied versus volume of material extruded per second, as shown in Figs. 8 and 9. Without gelling agent a straight line was obtained, while plastigels gave typically non-Newtonian curves.

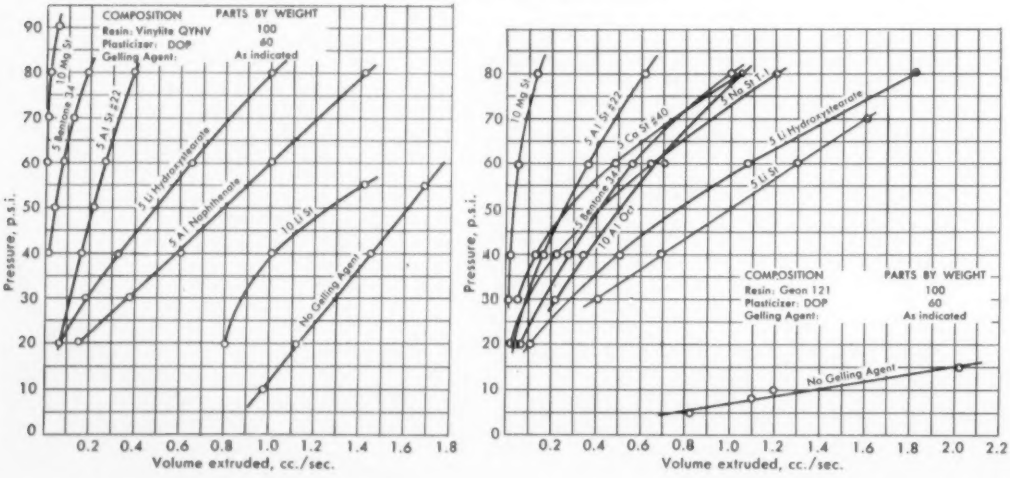
These results indicate that the effectiveness of the gelling agent is to some extent dependent on the resin. The influence of the type and amount of plasticizer employed bears further investigation, since the gelling efficiency of metallic soaps is largely dependent on the chemical nature and solvating action of the plasticizer. Due to the great number of possible formulations, this paper pertains to plastigels plasticized with DOP only. However, work with other plasticizer combinations now in progress shows the same metallic soaps to have good gelling action in a variety of formulations.

Heat Stability Tests

In order to test the behavior of the various compositions under heat, cylindrical plugs were fused at 350° F. for 15 minutes. All plastigels retained their shape well; however, some became discolored due to heat degradation of the resin. The plastigels containing aluminum and strontium stearates turned a light pink, the one containing Bentone 34 turned dark brown, while sodium, calcium, magnesium, lead, and lithium stearates had very good stabilizing properties. The plastigel prepared with lithium hydroxystearate showed the best clarity after fusion. Addition of one part Witco Stabilizer #70 to the aluminum stearate plastigel prevented discolora-

(*Continued on p. 218*)

Figs. 8 and 9—Effect of gelling agent on flow properties of plastigels, as measured with the Severs Extrusion Rheometer



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Structural Control of Cure of Phenolics

by Howard L. Bender*

FROM the time of the discovery of phenolic plastics by Dr. Leo H. Baekeland, variations of these original resins and compounds have been based almost entirely on changes in formulation—the juggling of such variables as hexa, phenol, filler content, water, and solvents in an effort to meet the needs of industry. An active investigation of the essential phenolic molecular structures and the effects of these structures upon the properties of phenolic materials has been carried on in our laboratories for more than a quarter of a century. Already this "structural approach" has resulted in the commercial availability of a class of phenolic molding materials (designated as C-22's) that offer the much-sought-after combination of fast-cure and hot rigidity. Continuing progress in the study of the fast-cure effect indicates possible future applications of these materials in the laminating, adhesive, and coating fields.

* Assistant Director, Research and Development Dept., Bakelite Co.

In the condensation reaction of phenol and formaldehyde, the first products readily isolated are the dihydroxydiphenylmethane isomers, commonly identified as diphenols. Normally, there are three types of diphenols depending upon the position of the formaldehyde linkage on the phenol molecule (Fig. 1). As condensation continues, the diphenols are converted to higher molecular weight polyphenols to form characteristic "two-step" phenolic resins. The isolation of the diphenols in pure crystalline forms and suggested methods for the production of these crystals represent the initial findings of our research group.[1]

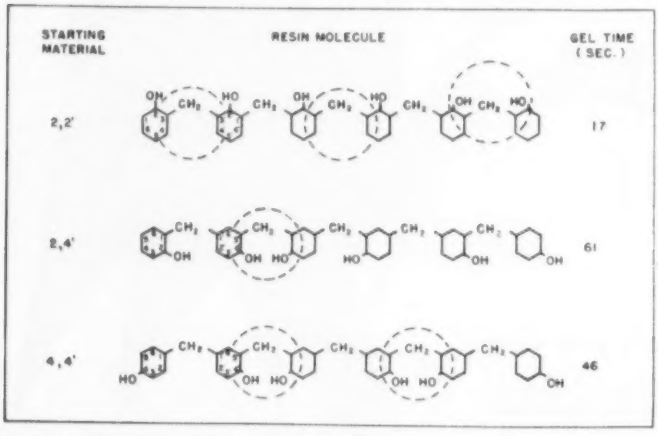


Fig. 1—Structure of resins derived from diphenol isomers

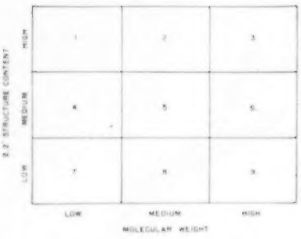
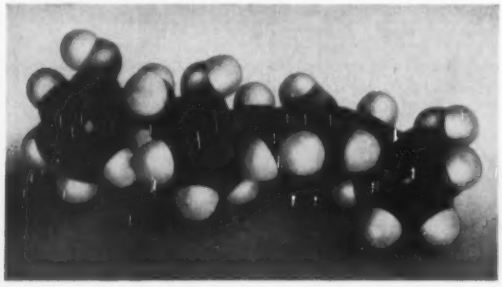


Fig. 2—Shown here is classification of "Two-Step" phenolic resins

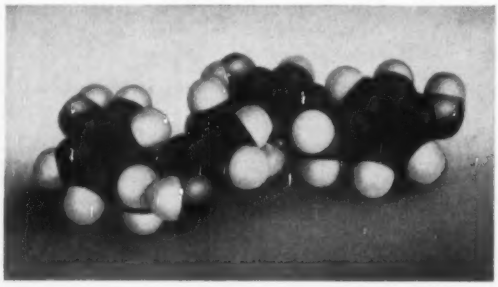
Of these isomers, the 2,2′ diphenol was of immediate interest and value because of its very rapid gelation characteristics with hexa hardener. This led directly to the second phase of research, the development and production of phenolic resins that retained the rapid gelation rates of the 2,2′ isomer and could be employed in present phenolic resin applications with minor changes in processing techniques. Several methods have been outlined for production of fast-curing "two-step" phenolic resins and molding compounds.[2]

[1] U.S.P. 2,464,207.
[2] U.S.P. 2,475,587.

Resin molecule with high 2,2′ structure content



Resin molecule with low 2,2′ structure content



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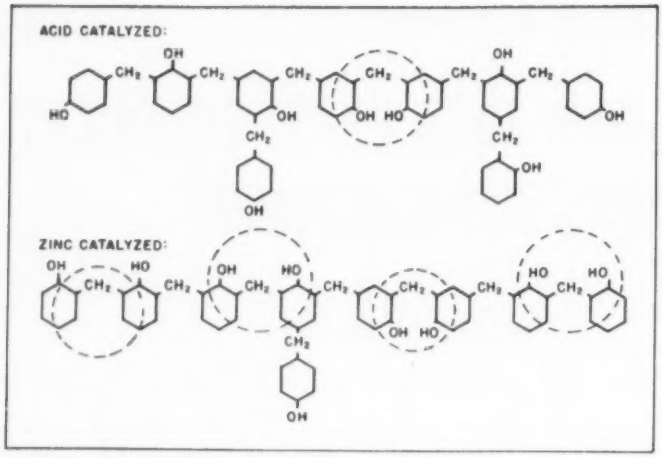


Fig. 3—Frequency of occurrence of 2,2′ structure in acid catalyzed and zinc catalyzed resin molecules

The six dihydroxydiphenylmethane isomers, as isolated in the pure crystalline state, are listed with their respective melting points in Table I. The crystalline structure of these isomers permits their purification by conventional methods[1], such as distillation or crystallization from a solvent. This produces a final product free from all reactants and by-products that present sources of difficulty in controlling phenolic resin properties. The purified crystals still exhibit full reactivity with hardening agents such as hexa.

These isomers, when reacted with formaldehyde, form molecular chains consisting of ring structures in multiples of two (Fig. 1). In general, resins derived from these diphenols retain the same relative speed of cure as the pure isomers. This is demonstrated in Table II, which shows corresponding gelation times for the resins and the isomers from which they are derived. Values for the gel time of resins based on the 2,3′, 3,3′, and 3,4′ isomers have been omitted because these structural forms do not ordinarily occur in the phenol-formaldehyde reaction. The gel times were obtained on a hot plate at 160° C. with 15% of hexamethylenetetramine.

Knowledge of the six isomeric structures has led to the adoption of

(*Continued on page 220*)

[1] H. L. Bender, A. G. Farnham, J. W. Guyer, F. N. Apel, and T. B. Gibbs, Jr., Ind. Eng. Chem. *44*, 1619-1623 (1952).

TABLE I—Melting Points of Diphenol Isomers

Isomer	*Melting Point*
	C°
2,2′-diphenylolmethane	118.5-119.5
2,3′-diphenylolmethane	95.5- 96
2,4′-diphenylolmethane	119 -120
3,3′-diphenylolmethane	102 -103
3,4′-diphenylolmethane	116 -116.5
4,4′-diphenylolmethane	162 -163

TABLE II—Gelation Time of Diphenol Isomers and Resins

Diphenol	*Gel Time Isomer*	*Resin*
	sec.	*sec.*
2,4′-diphenylolmethane	240	61
4,4′-diphenylolmethane	175	46
2,3′-diphenylolmethane	140	
3,4′-diphenylolmethane	130	
3,3′-diphenylolmethane	120	
2,2′-diphenylolmethane	60	17

Fig. 4—Infra-red absorption spectra of phenolic resins

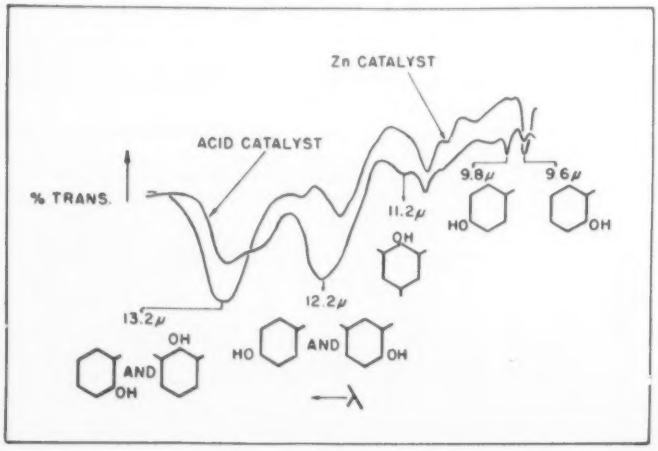
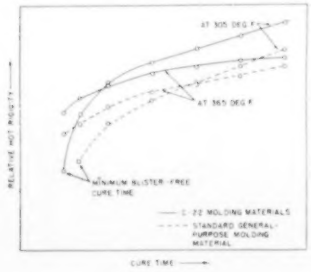


Fig. 5—Effect of 2,2′ structure on hot rigidity of phenolic molding materials



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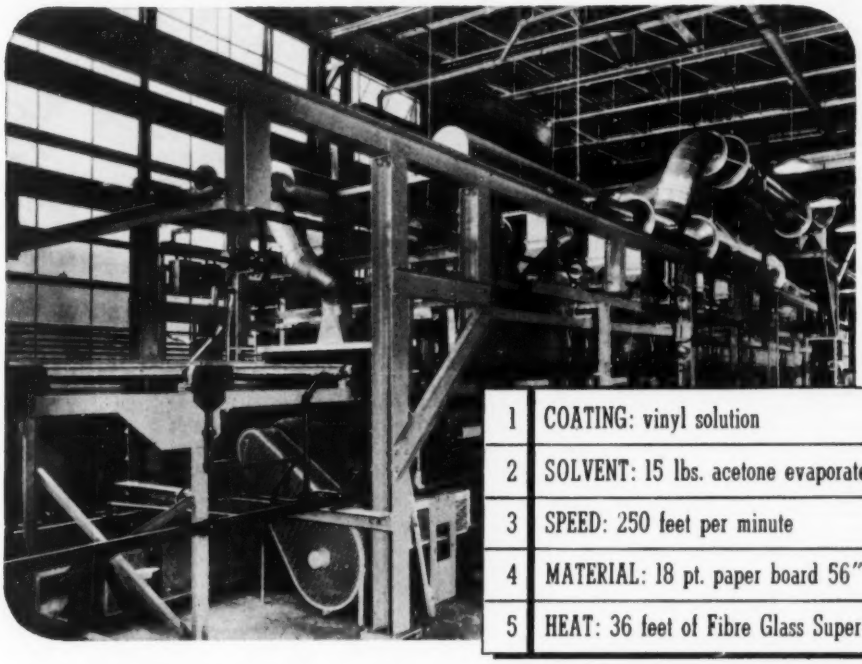

1	COATING: vinyl solution
2	SOLVENT: 15 lbs. acetone evaporated per minute
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Evaluation of Plastics for Liquid Rocket Propellant Applications†

by Paul M. Terlizzi* and Arthur E. Lenehan**

PLASTICS have entered virtually all the fields of engineering and chemistry and have accordingly appeared in the field of jet propulsion, in which the rocket has become increasingly important. The use of plastics in this field has been limited by the extreme temperatures encountered and the corrosivity of the propellants that are handled. Despite the problems imposed by these two conditions, plastics have found their way into liquid propellant rocket engine configurations as gasket material, O rings, seals, tubing, diaphragms, and expellant bags.

A typical example of the problems encountered in employing plastics in rockets is furnished by the application of flexible sheet plastics as expellant bags in liquid propellant rockets. The underlying principle is to utilize the bag as a trouble-free, one-shot feed system to move a liquid oxidizer (such as nitric acid) and a liquid fuel (such as aniline) from their respective storage tanks into the combustion chamber where the power-producing combustion takes place. The collapsed bag is surrounded within the stainless steel tank by the liquid. At the time that the rocket is fired, the bag is pressurized by admitting a gas such as nitrogen. The bag gradually inflates, thereby forcing the liquid from the tank. The reason that the pressurizing gas must be confined in the bag is to prevent any possible entrainment of gas with the liquid no matter what flight attitude the rocket may assume.

A plastic for use in expellant bags must, of course, furnish a good barrier between the gas and the liquid for those few important seconds during which the rocket motor is functioning. It must also be highly resistant to the liquid propellants in order that it may remain in its collapsed position in contact with the propellants for prolonged periods without deterioration. This property enables ground personnel to prepare rockets for flight hours and even days ahead of the time at which they are to be fired. The military importance of this consideration for rocket motors employed to power defensive ground-to-air guided missiles is obvious. Designs that would allow prepackaging months in advance would be ideal.

An expellant bag must also be flexible at extremes of temperature, which may range from −65° to 160° F.; it must be capable of being seamed adequately during the

Fig. 1—Sprayed plastic coatings separating from container walls, after seven weeks, due to diffusion of nitric acid

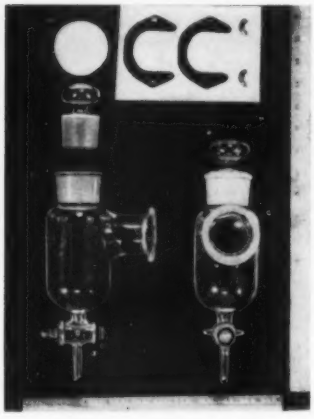

Fig. 2—Unassembled diffusion equipment. (The sample to be tested is shown in the upper lefthand corner)

† Statements and opinions expressed in this article are to be understood as individual expressions of the authors and not those of the Navy Department.

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bag fabrication; and it must be tough so that no failure will occur during the rapid unfolding which takes place while the pressurizing is going on.

Use With Nitric Acid

Taking as an example the use of white fuming nitric acid of 97.5% concentration as a typical oxidizer, it was found that only the halogenated polyethylene type plastics would fulfill these rigid specifications. Even with these plastics, there still exist some unsolved problems which are involved in the large scale use of rockets employing this particular type of feed system.

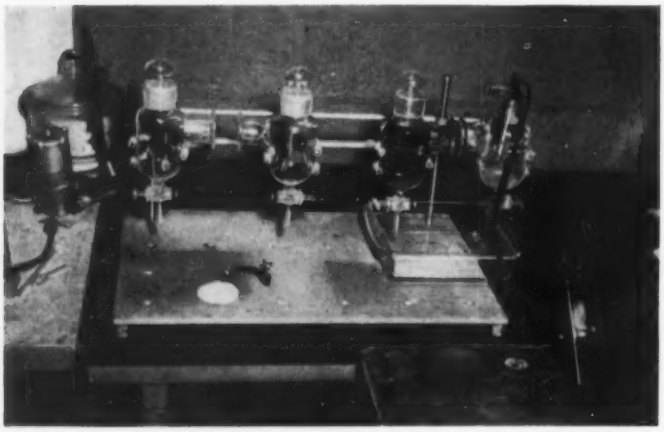
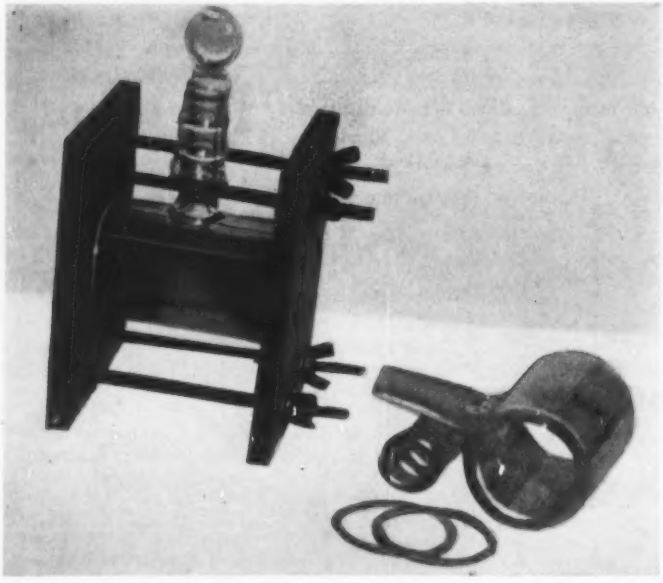


Fig. 3—Diffusion equipment assembly showing pH equipment

Fig. 4—Surface coating test assembly, showing simple glass cell and coated plate



In order to adequately evaluate various plastics for rocket applications where the problems are similar to those encountered with expellant bags, certain tests are needed to measure the desirable characteristics, and these tests must be specifically designed to simulate the condition of use in a rocket. It is indeed surprising to find that many of these particular tools have yet to be developed.

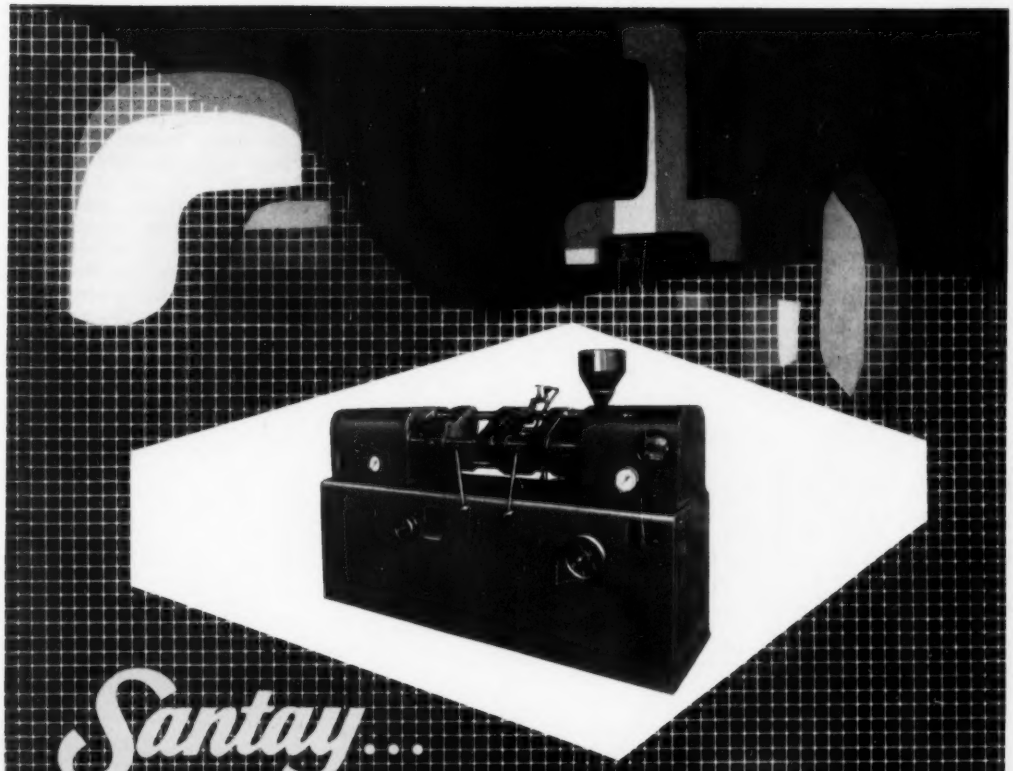
Special Tests

The need for special tests was clearly brought out during a recent search for a plastic coating that could be applied to mild steel for use in the construction of storage containers for propellants, especially the highly corrosive oxidizing acids. Standard stainless steel and aluminum drums and storage tanks are not entirely satisfactory from the rocket engineers' viewpoint because of corrosion problems. The contamination of acid by corrosion creates serious difficulty in rocket use by affecting the performance of the propellant, by clogging injector nozzles, and by lowering the efficiency of the chamber wall cooling system through the depositing of sludge in the cooling jacket. Furthermore, the use of a plastic coating on mild steel or the use of plastic in some other laminated form would release large quantities of critical stainless steel and aluminum for other important defense uses, while at the same time effecting a saving in weight.

Consequently, considerable effort has been expended in attempting to develop a continuous, pinhole-free, chemical-resistant coating. This research has led to the development of certain tests which measure the diffusion of acid through plastic films, the effect of acid on sprayed and bonded coatings, and the effect of the plastics on the propellant itself.

Diffusion of Acid through Films

One of the first problems encountered was that of diffusion of acid through plastic films. It was found that a certain plastic, when sprayed on mild steel and properly cured, resisted the action of acid for several weeks. However, after this period the film separated from the metal with the plastic still apparently unaffected by the acid (Fig.



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1). The failure was apparently due to diffusion. An exhaustive search failed to disclose any information on the diffusion rate of nitric acid through this type plastic. Nor could any of the normal diffusion methods be conveniently applied to measure-

By placing acid only in the lower part of the vessel, the diffusion of the vapor phase above this acid through the plastic can also be measured. This apparatus has operated well enough to serve as a convenient method for measuring this

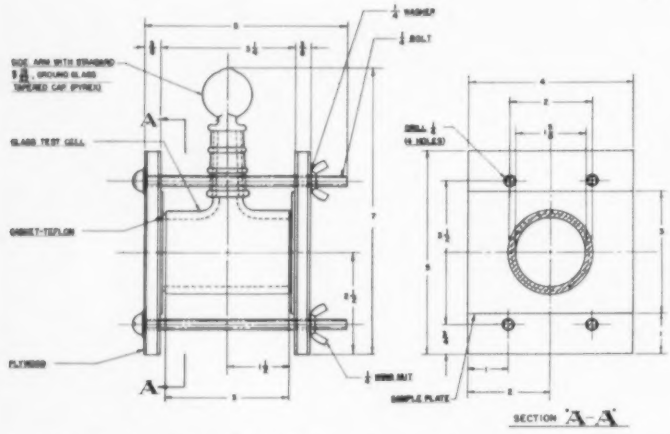


Fig. 5—Drawing shows construction details of surface coating test assembly

ments involving such a highly corrosive liquid. A new method, simple yet effective, had to be devised for the purpose of gaining the required information.

Apparatus Used

The apparatus used by the authors to compare the resistance of films to the diffusion of white fuming nitric acid and mixed acid (containing roughly 85% nitric acid and 15% sulfuric acid) is shown in Figs. 2 and 3. This apparatus is well adapted to diffusion measurements on these highly corrosive rocket oxidizers because attack on the equipment and handling of the highly dangerous acid are minimized.

The equipment consists of two Pyrex glass vessels with side arms terminating in ground glass circular surfaces. A disk of the plastic is placed between the two ground glass surfaces with a fluorocarbon grease and a clamp employed to effect the seal. Liquid acid is placed on one side of the film and distilled water on the other. The rate of diffusion through the film is measured by the change in the pH as indicated by a pH meter.

characteristic of selected plastic films.

A method was also required to check the effect of acid on sprayed and bonded coatings without employing an entire container. This requirement suggested the use of a simple glass cell that allowed a coated plate to be clamped in place with its surface in contact with the propellant without any of the edge effects which accompany immersion. This arrangement is shown in Figs. 4 and 5.

Resistance of Coatings to Acid

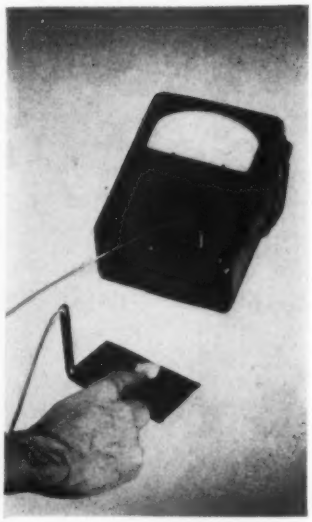
Two test plates, approximately 3 by 4 in. are clamped on either end of a Pyrex glass cylinder 3 in. long and 2 in. in diameter. A fluorocarbon grease and Teflon gaskets are employed to effect a seal between the ground glass ends of the cylinder and the protective coating on the metal. To the side of the cylinder a side arm and a standard tapered ground glass cap were fitted. This side arm provides an opening for filling the cell with acid and also furnishes the necessary vent for vapors generated from any decomposition of the acid.

Prior to clamping in the test cell the plates are checked with an ohmmeter in order to determine the presence of any pinholes (Fig. 6). One terminal is connected to the bare metal at a corner of the plate, and the other terminal is fitted with a wad of cotton, which has been dipped in a mixture of weak acid and a wetting agent. This probe is employed to scan the surface in search of pinholes. The passage of a current indicates that the wetting agent has drawn the electrolyte into a pinhole in the coating and bare metal has been reached.

New Test Sought

This pinhole detection system, although helpful, is not entirely satisfactory, as small imperfections in the plastic coating are overlooked. High voltage and other techniques

Fig. 6—Ohmmeter is used in detection of pinholes on test sample prior to insertion in apparatus shown in Fig. 5



have been investigated, but an improved, non-destructive test is still sought.

While clamped in the test cell, the sample plate with its protective coating is checked periodically to determine the time at which the first signs of failure appear. One terminal of an ohmmeter is inserted in the acid and the other to an ex-

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posed corner of the underlying base metal. Any penetration through the film will close the electric circuit and produce a leakage current which may be read on the ohmmeter. Quite often the failure takes

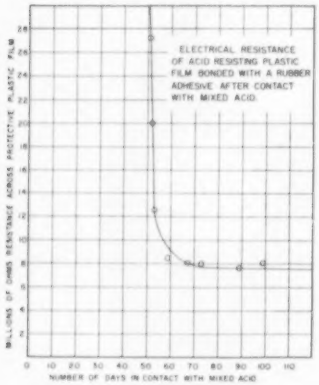
ELECTRICAL RESISTANCE OF ACID RESISTING PLASTIC FILM BONDED WITH A RUBBER ADHESIVE AFTER CONTACT WITH MIXED ACID
BILLIONS OF OHMS RESISTANCE ACROSS PROTECTIVE PLASTIC FILM
NUMBER OF DAYS IN CONTACT WITH MIXED ACID

Fig. 7—Electrical resistance of plastic film

the form of a uniform reduction in resistance across the exposed area due to absorption of the acid down through the thickness of the coating. A typical curve, showing the manner in which the electrical resistance drops as a function of time of exposure, is given in the chart, Fig. 7.

In general, compatibility tests determine whether the material under observation can be depended upon to coexist with the chemical under specified conditions of time and temperature. Usually these tests are largely one-sided, i.e., it is the effect on the construction material that is of primary importance. In liquid rocket applications, however, the quality of the propellant is exceedingly critical and any contamination might easily lead to poor performance on the part of the rocket engine.

Accordingly, the usual weight-gain, weight-loss test is implemented by periodic chemical analyses of the propellant to determine, for example, the leaching of any plasticizing material or the acceleration of any propellant decomposition that could be attributed to the particular plastic under consideration at the moment.

Problem of Decomposition

The problem of decomposition deserves special consideration. To check this property a stainless steel pressure bomb has been devised. The plastic under test is formed into the shape of a cylindrical lining and inserted into the bomb chamber. Other units are set up with metallic or glass linings as control samples. The selected propellants are carefully measured into the lined containers and the bombs are sealed and stored at various constant temperature levels. The relative decomposition of the liquid stored in plastic compared with those stored in glass or aluminum is indicated either by the reading on a pressure gauge or by chemical analysis of the propellant at the conclusion of the test. As an illustration, it was found that when nitric acid was stored for 15 hr. at a temperature of 60° C. in a liner of a certain plastic under test, considerable NO_2 and H_2O were formed. Under actual operating conditions this excessive water formation would result in a poor rocket engine performance because the propellant's ignition characteristic would be adversely affected.

Fig. 8—Plastic lining bag with disk-type closure, and metal containers

Tests of Containers

Following the laboratory tests, the next step in determining the dependability of a plastic protective coating is the testing of a sample fabrication. The three types of construction that have been considered thus far are sprayed coatings on small drums, sheet plastic lining bags for containers, and plastic sheet that has been bonded to steel and then formed into containers. The spray technique is quite routine, but the latter two applications are rather unique.

For the liner bag the plastic is formed into the desired shape, the seams are sealed, and the bag is inserted into the metal container. After filling with acid, the unit is closed and the field storage period is begun. Samples of this type test are pictured in Fig. 8. An analysis of the propellant and a visual inspection of the container are made periodically. A bag liner is considered satisfactory if it permits the retention of the propellant for a period of 9 mo. to 1 yr. without adversely affecting the propellant and the container.

Tensile Strength Needed

The use of such a lining bag for storing liquid rocket propellants may seem somewhat revolutionary. It is readily seen that a plastic for this type of service must possess high tensile strength, and the problem of designing the proper type of closure is still unsolved. However, experience has shown that plastic sheets to a large degree circumvent the problem of pinholes so prevalent

(*Continued on p. 223*)

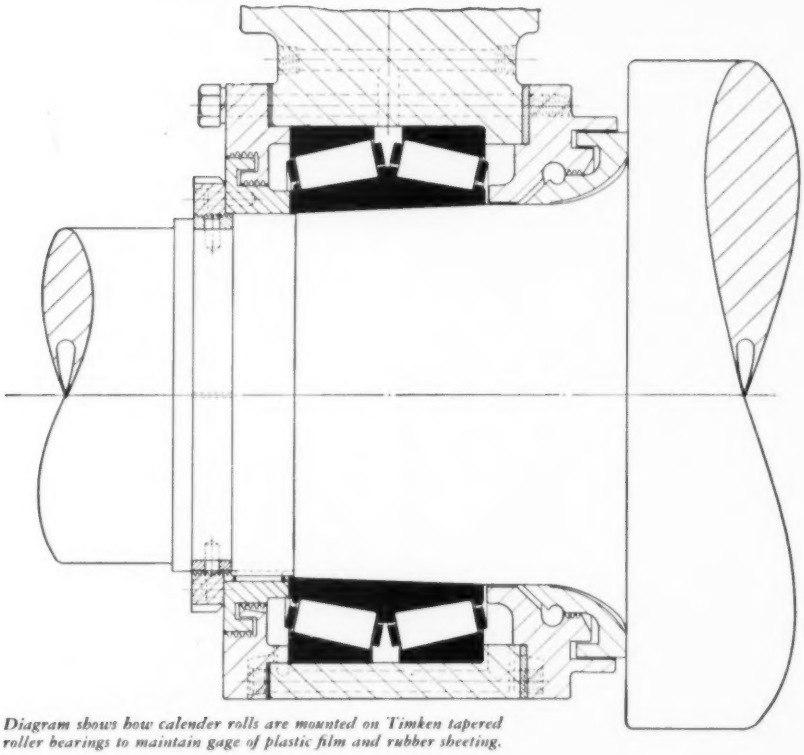

Diagram shows how calender rolls are mounted on Timken tapered roller bearings to maintain gage of plastic film and rubber sheeting.

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

PLASTICS DISTRIBUTION. Brit. Plastics *25*, 282-5 (Sept. 1952). Two recent publications contain much interesting information regarding the production and application of plastics materials in Great Britain. The first, based on the 1948 Census of Production, gives production figures for certain plastics articles in that year, and by comparing these figures with others that have appeared elsewhere it is possible to gain some idea of trends. The second, a chart recently drawn up by the Distributors of Builders' Supplies Joint Council, lists building fitments in regular demand in which certain materials, including plastics, are agreed by the Council as being suitable alternatives to the traditional materials (steel, zinc, copper, etc.). This chart is reproduced together with a commentary on its relevance to the plastics industry.

FIBERS. C. S. Grove, Jr., J. L. Vodonik, and R. S. Casey. Ind. Eng. Chem. *44*, 2318-24, 2371-75 (Oct. 1952). Developments in the past year in the field of fibers are reviewed. Expansion of synthetic fiber development has continued. New plants with increased production were built or planned for the newer synthetics. Research on dyeing and the use of new raw materials show much promise. Development of sources of new natural fibers, especially in the hard fiber field, was carried out. Probably the most important development is the study of blends of natural and synthetic fibers to obtain the most desirable properties of each. 179 references.

Materials

ORGANIC TIN STABILIZERS FOR VINYL PLASTICS. H. V. Smith. Plastics (London) *17*, 264-6 (Sept. 1952). The reasons for the degradation of chlorine-containing vinyl resins under the influence of light and heat, and details of the properties of an "ideal" stabilizer are discussed. The production of tin stabilizers in this country and their manifest chemical and physical advantages over many of the commonly known types open up the opportunity of introducing still higher qualities of polyvinyl chloride. This refers not only generally to more stable types but also to perfectly crystal-clear moldings of thick section, to the production of non-toxic types for use with food (e.g., milk and beer hose) and to conditions of high temperature (e.g., extrusion of hard polyvinyl chloride).

STYRENATION OF ESTERS OF BISPHENOL-EPICHLOROHYDRIN CONDENSATES. J. W. McNabb and H. F. Payne. Ind. Eng. Chem. *44*, 2394-7 (Oct. 1952). Homogeneous products may be obtained from the styrenation of the dehydrated castor oil fatty acid esters of Epon resins 1001 and 1004. A comparison of benzoyl peroxide and di-*tert*-butyl peroxide catalysts showed the latter to be superior in respect to the efficiency of the reaction under the conditions used. The products obtained with di-*tert*-butyl peroxide were decidedly superior in color to those obtained when benzoyl peroxide was used. Preliminary evaluations of these copolymers indicate improved resistance to water and alkali, while maintaining the excellent adhesion and flexibility characteristics of the Epon resin esters.

Properties

ARC RESISTANCE: (II) EFFECT OF TESTING CONDITIONS ON TRACKING PROPERTIES OF THERMOSETTING INSULATING MATERIALS. M. Olyphant, Jr. ASTM Bulletin No. 185, 31-8 (Oct. 1952). The conditions under which the arc-resisting properties of materials are determined can be varied by changing either the nature of the test atmosphere, the form of electrode arrangement, or the nature of the discharge. The results of tests are presented, which reveal that materials in general are more resistant to tracking under arcs in nitrogen, hydrogen, and helium, and less resistant in an atmosphere containing 5 percent chlorine, than they are in air alone. Arc resistance is shown to decrease with increasing specimen temperature, the rate of decrease varying somewhat among materials. Studies of comparative tracking properties under continuous current arcs, raised electrode conditions, and pulse arcs are discussed and indicate the following: The order of materials is dependent not only upon the nature of the discharge and arrangement of electrodes but also upon the value of current in a given type of arc. A second criterion of arc resistance is found in the minimum current or power below which a material will not track. The minimum tracking powers in the pulse and continuous arc tests are shown to be of the same order in spite of the widely different levels of current and voltage in the two arcs. It is concluded that power is a more basic factor in determining breakdown than arc current. A calculation of energy consumed in promoting tracking reveals that there are particular values of arc power at which tracking is most efficiently initiated. Data for various types of thermosetting plastics are reported.

FRICTIONAL AND ELASTIC PROPERTIES OF HIGH POLYMERIC MATERIALS. B. Lincoln. Brit. J. Appl. Physics. *3*, 260-263 (Aug. 1952). Measurements of the area of contact of a nylon hemisphere pressed against a glass surface at various loads were in agreement with the assumption of elastic deformation. Effects of relative humidity, surface contamination, and surface roughness on friction of polymers, mostly nylon, were also studied. The friction coefficient of polymer fibers on cylinders decreased as the surfaces of the latter were made rougher; this is explained on the basis of elastic deformation of surface asperities.

STRESS RELAXATION IN PLASTICS AND INSULATING MATERIALS. E. E. Wright. ASTM Bulletin No. 184, 47-9 (Sept. 1952). Organic materials are in ever-increasing use for mechanical and electrical devices where satisfactory performance is required over long periods of time and under a wide assortment of atmospheric in-

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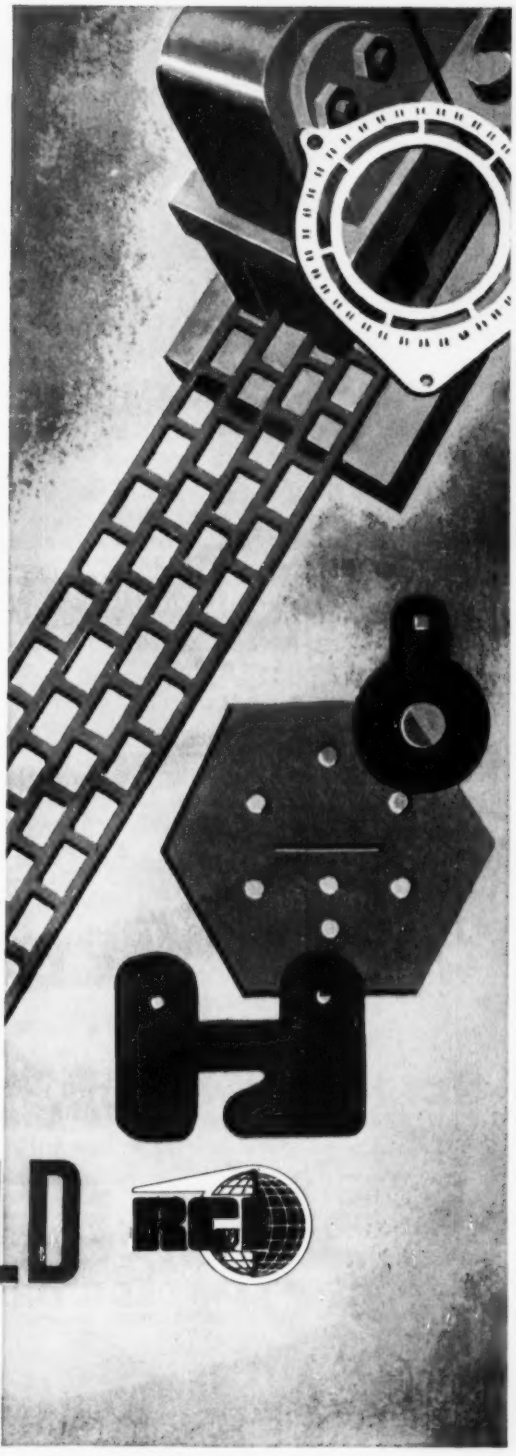

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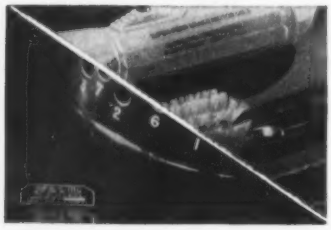

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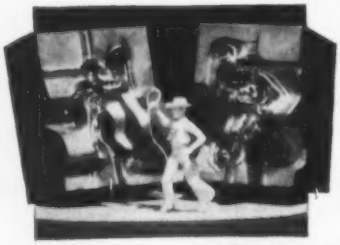

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fluences. Although the dimensional stability of plastics and electrical insulating materials under no-load conditions has been established reasonably well, there is an important gap in existing knowledge with regard to a material's ability to maintain adequate counter-stresses under compressive loading. ASTM Method of Test D 621-51 uses a constant-load system and measures the material's resistance to gross deformation. However, this fails to simulate the usual application where the material is subjected to constant deflection (such as fastening devices, inserts, etc.) and is required to maintain adequate counter-stresses for the foreseeable life of the part. Therefore, it has been necessary to integrate data from Method D 621 with long practical experience in order to extrapolate between two dissimilar systems. A constant-deflection procedure for direct measurement of stress relaxation or change thereof, thereby permitting evaluation in terms of a material's ability to maintain a tight assembly under conditions simulating actual use, is described. Apparatus for carrying out the test is described and typical data illustrating its usefulness are included.

MOLECULAR WEIGHT DEPENDENCE OF INTRINSIC VISCOSITY OF POLYMER SOLUTIONS. W. R. Krigbaum, L. Mandelkern, and P. J. Flory. J. Polymer Sci. *9*, 381-4 (Oct. 1952). Intrinsic viscosities of low molecular weight polystyrene fractions measured in cyclohexane at 34° C. are in accord with the relationship intrinsic viscosity equals a constant, K, multiplied by the square root of the molecular weight. Even at molecular weight of only 4000, the observed value of K agrees with that for high molecular weights.

Testing

APPLICATION OF VOLUME CHANGE CHARACTERISTICS OF A SULFONATED LOW-CROSS-LINKED STYRENE RESIN. C. Calmon. Anal. Chem. *24*, 1456-8 (Sept. 1952). The volume of sulfonated polystyrene resins depends on the cross linking of the resin, the cation in the exchange position, and the type and concentration of the solution in equilibrium with the resin. The above properties are utilized in the application of the low cross-linked exchangers as a new analyti-

cal tool. The initial results show that these resins may be used for determining concentrations of certain solutions, ionic species of given valences, and reaction end points where changes in concentration or in valence take place. A single bead of resin may be used for repeated analyses. If the resin is used in a column, only a few minutes are needed for an analysis. The method requires only one standardization, and, therefore, may find numerous applications.

Chemistry

REACTIVITY RATIOS OF SOME MONOMER PAIRS. H. C. Haas and M. S. Simon. J. Polymer Sci. *9*, 309-14 (Oct. 1952). To continue the study of the effect of structure on reactivity, an experimental investigation of the free radical copolymerization behavior of eight monomer pairs was made. The monomer pairs include: vinyl acetate, methyl vinyl ketone; vinyl acetate, 1, 3-acetoxybutadiene; acrylonitrile, 1, 3-acetoxybutadiene; methylacrolein, acrylonitrile; vinylsulfonic acid, methyl methacrylate; 2,5-dichlorostyrene, 2,5-dimethylstyrene; vinyl acetate, fumaryl chloride; and styrene, fumaryl chloride.

DEGRADATION OF LONG CHAIN MOLECULES AS A REVERSE POLYMERIZATION PROCESS. H. H. G. Jellinek. J. Polymer Sci. *9*, 369-80 (Oct. 1952). Kinetic equations are derived; first, for degradation of polymers as a reversal of polymerization processes and, second, for degradation polymerization processes ultimately leading to equilibria between monomer and polymer.

Molding and Fabricating

VACUUM METALLIZING AS A DESIGN TOOL. J. G. Seiter. Elec. Manuf. *50*, 148-9, 334, 336 (Nov. 1952). The technique of coating plastics and other materials with metals by vacuum deposition is described. Metals or salts are heated sufficiently in a high-vacuum chamber to raise their melting points to the point of evaporation. The molecules then travel in free space until intercepted by the walls of the chamber or the objects or materials to be metallized. Here they form a thin but uniform coating of perfect fidelity to the original. In electrical parts, such metal coatings contribute conductance, shielding, resistance, and other desirable prop-

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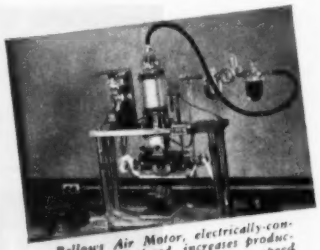

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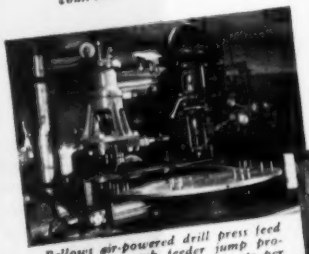

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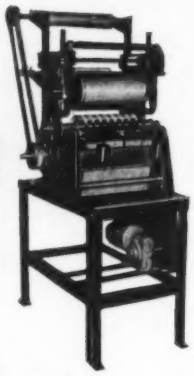

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erties. For example, quartz crystals can be vacuum-metallized with silver to permit soldering electrical leads to the crystals. Metal coatings can be deposited under high vacuum on all phenolics, ureas, melamines, methacrylates, styrenes, polystyrenes, and other plastics; also on glass, paper, textiles, and other surfaces. Some plastics, however, are unsuitable for vacuum metallizing owing to the protracted period required for out-gassing. For many products, out-gassing in a separate chamber is recommended. With highly adsorbent products out-gassing is often followed by flooding with bone-dry air or inert gas to protect the surface during the brief period of transfer from the out-gassing to the metallizing chamber. Wood, rubber, and cork are also unsuitable for vacuum metallizing. Many applications are described.

Applications

FUNCTIONAL PROPERTIES OF SYNTHETICS. J. B. Quig and R. W. Dennison. Ind. Eng. Chem. *44*, 2176-86 (Sept. 1952). The general advantages which are common to dynel, nylon, Acrilan, Orlon acrylic fiber, and Dacron polyester fiber are listed. The known functionally significant properties of each synthetic fiber and Vicara protein fiber are pointed out. Consideration is given to how present synthetic fibers differ from the natural and man-made in important respects. The most striking and important differences result from their differences in moisture sensitivity. Textile research on fabrics from blended fibers is drawn on for evidence that the properties of synthetic fibers may be utilized to manufacture better fabrics and that hydrophobic and hydrophilic fibers are complementary to each other.

EPOXY RESINS FOR WIND-TUNNEL MODELS. Brit. Plastics 25, 300-3 (Sept. 1952). Wind tunnel models are made by bonding sheets of metal and wood with an epoxy resin adhesive and filling the offsets and cracks with another epoxy resin composition to obtain smooth contours.

DEVELOPMENT OF MOLDED REFLECTORS. A. A. Tomkins, Brit. Plastics 25, 288-92 (Sept. 1952). The design of reflectors and the molding of them from plastic materials is discussed.

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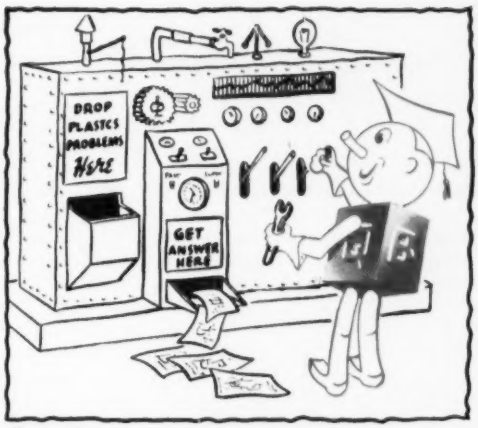

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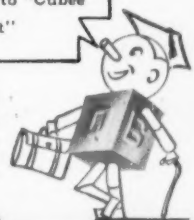

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THIXOTROPIC COMPOSITIONS. B. W. Nordlander, J. A. Loritsch, and R. E. Burnett (to General Electric). U.S. 2,610,958-9-60-61, Sept. 16. Unsaturated alkyd resin, a filler of iron or chromium oxide, or vermiculite.

STYRENE COPOLYMER. W. H. Smyers and D. W. Young (to Dow). U.S. 2,610,962, Sept. 16. Styrene-isobutylene copolymers.

COPOLYMERS. K. W. Doak and K. E. Wilzbach (to U.S. Rubber). U.S. 2,610,963-4, Sept 16. Fiber-forming copolymers of 1, 3-butadienes with dialkyl methylene-malonates.

POLYMERIZATION. E. J. Vandenberg (to Hercules). U.S. 2,610,965, Sept. 16. Polymerization of vinylidene compounds using a hydroperoxide catalyst and a basic nitrogen compound.

RESIN IMPREGNATION. C. C. Sachs (to A. H. Kerr). U.S. 2,611,336, Sept. 23. Machine for resin-impregation of fabric.

GLASS FIBERS. R. Steinman (to Owens-Corning). U.S. 2,611,718, Sept. 23. Glass fibers coated with Werner-type complexes to promote adhesion to polyester resins.

COATING. A. M. Borders (to Wingfoot). U.S. 2,611,719, Sept. 23. Base coated with a high styrene-butadiene copolymer.

COPOLYMER. H. Rudoff (to Shawinigan Resins). U.S. 2,611,754, Sept. 23. Vinyl acetate-allyl acetate copolymer emulsion.

POLYVINYL BUTYRAL. W. H. Bromley, Jr. (to Shawinigan Resins). U.S. 2,611,755, Sept. 23. Polyvinyl butyral dispersions.

RESIN. I. Pockel (to Cambridge Industries). U.S. 2,611,756, Sept. 23. Polyvinyl acetate resin plasticized with a polyester resin.

PHENOLIC RESIN. C. H. Hempel (to Heresite). U.S. 2,611,759, Sept. 23. Phenolic molding composition.

CONDENSATE. E. M. Geiser (to Universal Oil Products). U.S. 2,611,760, Sept. 23. Condensate of formaldehyde with a copolymer of a vinyl aromatic compound and an aliphatic monoolefin.

POLYMERS. J. B. Dickey and T. E. Stanin (to Eastman Kodak). U.S. 2,611,761, Sept. 23. Alkyl alpha-fluoroacetoxy acrylates and polymers thereof.

VINYL POLYMERS. S. B. Luce (to Swift). U.S. 2,611,762, Sept. 23. Polymerization of vinyl acetate.

VINYL POLYMERS. G. D. Jones (to General Aniline). U.S. 2,611,763, Sept. 23. Amphoteric vinyl interpolymers.

COPOLYMERS. E. M. Geiser and A. J. deRosset (to Universal Oil Products). U.S. 2,611,764, Sept. 23. Copolymers of oxidized isobutylene with hydrocarbons.

INTERPOLYMERS. J. B. Dickey (to Eastman Kodak). U.S. 2,611,765, Sept. 23. Interpolymers of alpha-acyloxyacrylonitriles.

CELLULOSE ESTERS. J. J. Allen and J. A. Hawkes (to Celanese). U.S. 2,611,767, Sept 23. Process for the manufacture of cellulose acetate-stearate.

COPOLYMERS. L. J. Tyler (to Dow Corning). U.S. 2,611,774, Sept. 23. Diphenylsiloxane copolymers.

RESINS. J. L. Speier, Jr. (to Dow Corning). U.S. 2,611,777, Sept. 23. Phenylol silane resins.

HARDBCARD. O. Spence (to Masonite). U.S. 2,612,445, Sept. 30. Hardboard containing furfuryl alcohol resins.

ADHESIVES. R. G. Brown (to Du Pont). U.S. 2,612,463, Sept. 30. Polyamide bookbinding adhesives.

ADHESIVE. C. N. Cone (to U.S. Plywood). U.S. 2,612,481, Sept. 30. Rapid setting phenolic adhesive containing a chromium compound.

TEXTILE TREATMENT. T. J. Rasmussen (to General Electric). U.S. 2,612,482, Sept. 30. Rendering textiles water-repellent by treatment with resins.

COATINGS. W. C. Dearing (to Libbey-Owens-Ford). U.S. 2,612,483, Sept. 30. Urea-formaldehyde adhesives and coatings.

DISPERSIONS. S. G. Bankoff (to Du Pont). U.S. 2,612,484, Sept. 30. Polytetrafluoroethylene dispersions.

DISPERSIONS. M. Baer and R. G. Fordyce (to Monsanto). U.S. 2,612,485, Sept. 30. Aqueous dispersions of sulfonated polystyrene.

ADHESIVE. M. E. Cameron (to Monsanto). U.S. 2,612,486, Sept. 30. Styrenemonoalkyl maleate-polyvinyl alcohol interpolymer emulsion adhesive.

PLASTICS. C. B. Havens (to Dow). U.S. 2,612,489, Sept. 30. Biphenylyl esters of aliphatic acids.

POLYMERS. C. W. Gould (to Hercules). U.S. 2,612,490, Sept. 30. Polymers of vinylidene compounds with an alpha, alpha-dialkylarylmethyl hydroperoxide.

POLYMERS. T. W. Evans, D. E. Adelson, and L. N. Whitehill (to Shell). U.S. 2,612,491, Sept 30. Mixed polycarboxylic acid esters of alkylidene glycols and polymers thereof.

COPOLYMERS. P. O. Tawney (to U.S. Rubber). U.S. 2,612,492, Sept. 30. Copolymers of diallylic phthalates and allylic alcohols.

TUBING. G. A. Lyon. U.S. 2,612,656, Oct. 7. Apparatus for making plastic tubing.

MOLDING. G. B. Sayre (to Boonton). U.S. 2,612,658, Oct. 7. Transfer molding press.

AIR FILTER. W. H. Nicol (to Wingfoot). U.S. 2,612,966, Oct. 7. Polyethylene air filter.

PLASTICIZERS. H. B. Knight (to U.S.). U.S. 2,613,157, Oct. 7. Condensates of phthalic anhydried and 9,10-dihydroxy stearic acid.

SUSPENSIONS. L. K. Osdal (to Du Pont). U.S. 2,613,193, Oct. 7. Sprayable polytetrafluoroethylene compositions.

POLYMERS. G. E. Ham (to Chemstrand). U.S. 2,613,196, Oct. 7. Solutions of acrylontrile polymers re-

Molded Fiberglass

Blows Its Own Horn — BETTER

Pictured here are five steps in the production of a new loudspeaker horn in our plant. This new horn has better acoustics, better weather resistance, less weight, and will not dent. Its use should result in big changes in the horn business.

Better—to make something better using Molded Fiberglass is our aim. Sometimes our designs result in economies, so better and cheaper are combined, but always our products are better.

We at Molded Fiberglass Co. are constantly trying to become better also—better and larger equipment, better trained personnel, better finished products, and bigger and better production. In the last six months we have installed six mammoth presses like the one shown on this page, plus two slightly smaller, three more big preform machines, 12,000 more sq. ft. of floor space, and several new technical sales and service men to give closer attention to customers' needs.

For four years we have produced the majority of the non-military custom-molded fiberglass-reinforced plastic parts produced, as well as trays and tote boxes. We specialize solely in this field, our equipment is unsurpassed and specialized, our attention is undivided.

For custom-molding write
MOLDED FIBERGLASS CO.
FORMERLY MOLDED RESIN FIBER CO.
Ashtabula, Ohio

For material handling trays
MOLDED FIBERGLASS TRAY CO.
Linesville, Penna.

For flat sheet and fabricated parts and boxes
MOLDED FIBERGLASS SHEET CO.
Ashtabula, Ohio

Photos on this page courtesy Molded Resin Fiber Co.

Spraying binder and blowing fibrous glass is an early step in building preform

Finished preform, with metal bead inserted in edge, is put into curing oven

Cured preform, removed from oven, is dropped into cast steel female cavity on the press

After weighed polyester resin has been added to the preform in the mold, pressure is applied

Completed horn, weighing half as much as similar metal unit, can support weight of a 200-lb. man

Using a lifting tool, operator removes finished speaker horn from the mold

acted with a trialkyl amine.

RESIN. H. Honel and H. Manzano. U.S. 2,613,198, Oct. 7. Resol-alkyd resin product.

SILOXANES. P. A. DiGiorgio and M. M. Safford (to General Electric). U.S. 2,613,199, Oct. 7. Elastic hydrocarbon substituted polysiloxanes.

ION EXCHANGE. C. H. McBurney (to Rohm and Haas). U.S. 2,613,200, Oct. 7. Diketone ion-exchange resins.

POLYMERIZATION. G. F. Roedel and R. L. Myers (to General Electric). U.S. 2,613,202-3, Oct. 7. Method for polymerizing chlorotrifluoroethylene.

MOLDING. G. W. Borkland (to Owens-Corning). U.S. 2,613,397, Oct. 14. Molding compositions containing low pressure thermosetting resinous binder.

MOLDING. C. A. Nichols, R. B. Bower, G. L. Weiser, J. R. Edwards, W. A. Fletcher, H. W. McCoy, and B. S. Sample (to General Motors). U.S. 2,613,450, Oct. 14. Means for heating loose molding powder.

CUTTER. A. Sharp and G. Sharp. U.S. 2,613,618, Oct. 14. Cutting mechanism and extrusion nozzle for continuously moving plastic bars.

MOLD. A. E. Willomitzer. U.S. 2,613,619, Oct. 14. Multiple mold continuous plastic forming machine.

STERILIZING. P. Kollsman. U.S. 2,614,027, Oct. 14. Sterilizing hollow thermoplastic articles.

HOLLOW ARTICLES. R. J. Francis. U.S. 2,614,058, Oct. 14. Forming hollow plastic articles of filaments and liquid resin.

RADAR DOMES. L. S. Cooper (to Rubatex). U.S. 2,614,059, Oct. 14. Molded fiber glass, rubber, and alkyd resin article.

ION EXCHANGE. L. A. Lundberg (to American Cyanamid). U.S. 2,614,085, Oct. 14. Use of cationic surfactant to produce beads of anion exchange resin.

POLYVINYL ACETATE. N. Turnbull (to Du Pont). U.S. 2,614,087, Oct. 14. Preparation of polyvinyl acetate emulsion.

POLYVINYL ACETATE. J. E. Bristol and N. Turnbull (to Du Pont). U.S. 2,614,088, Oct. 14. Emulsion polymerization of vinyl acetate.

STABILIZER. S. J. Averill (to B. F. Goodrich). U.S. 2,614,090, Oct. 14. Stabilization of polyvinylidene cyanide solutions.

VINYLIDENE CHLORIDE. J. H. Reilly (to Dow). U.S. 2,614,092, Oct. 14. Infusible copolymer of vinylidene chloride and acrylonitrile.

COPOLYMER. G. L. Wheelock (to B. F. Goodrich). U.S. 2,614,093-4, Oct. 14. Resin composed of butadiene, acrylonitrile, and divinylbenzene.

STABILIZER. T. H. Shelley, Jr. (to B. F. Goodrich). U.S. 2,614,095, Oct. 14. Mercapto acid amide as heat stabilizer for a chlorine containing polymer.

CONDENSATE. R. J. Spahr (to Borden). U.S. 2,614,096, Oct. 14. Condensates of phenol, formaldehyde, and unsubstituted dihydric phenols.

POLYMERS. L. Akobjanoff. U.S. 2,614,097, Oct. 14. Metallo-thioplasts.

ION EXCHANGE. W. C. Bauman and R. McKellar (to Dow). U.S. 2,614,099, Oct. 14. Anion exchange resins.

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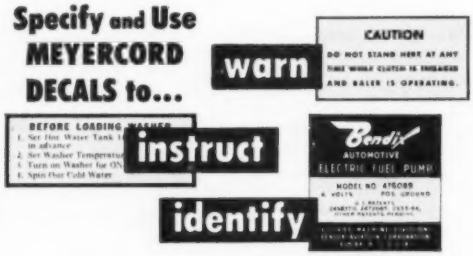

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man. U.S. 2,614,103, Oct. 14. Reaction products of starch with glycol-alkylolamine condensates.

MOLDING COMPOSITION. R. F. Williams (to Eastman Kodak). U.S. 2,614,292, Oct. 21. Granules of cellulose acetate butyrate coated with a cellulose acetate butyrate of higher acyl content.

PLATEN. D. E. Hervey (to Hervey Foundation). U.S. 2,614,590, Oct. 21. Press platen for laminated material.

POLYMERIZATION. I. Allen, Jr., W. R. Marshall, and G. E. Wightman (to Carbide and Carbon). U.S. 2,614,910, Oct. 21. Apparatus for continuous polymerization.

STRIPPING FILM. G. F. Nadeau, C. B. Starck, and C. F. Smith (to Eastman Kodak). U.S. 2,614,932, Oct. 21. Surface hydrolyzed cellulose triacetate film.

CELLULOSE ESTERS. G. D. Hiaff and R. F. Williams (to Eastman Kodak). U.S. 2,614,941, Oct. 21. Stabilized cellulose esters.

COMPOSITE FABRICS. H. Ewing and A. Mellor (to Celanese). U.S. 2,614,954, Oct. 21. Composite fabrics bonded with polyvinyl chloride.

LAMINATES. T. M. Halsall (to L. A. Darling). U.S. 2,614,955, Oct. 21. Pressure molding laminates.

VENETIAN BLINDS. J. L. Hunter and T. A. Martin (to Hunter Douglas). U.S. 2,614,956, Oct. 21. Plastic Venetian blind ladders.

POLYMERS. J. C. Robinson, Jr. and W. S. Ropp (to Hercules). U.S. 2,614,997, Oct. 21. Polymers of vinyl rosin esters.

POLYETHYLENE. H. W. Bradley (to Du Pont). U.S. 2,615,000, Oct. 21. Sulfonamides of chlorosulfonated polyethylene.

ENAMELS. E. Q. Bullock, Jr. and F. J. Emig (to Du Pont). U.S. 2,615,001, Oct. 21. Phenolic polyvinyl formal polythene enamels for metal wire.

MOLDING POWDER. M. J. Hurwitz (to Du Pont). U.S. 2,615,002, Oct. 21. Polyamide molding powder.

RESIN. T. J. Suen and A. M. Schiller (to American Cyanamid). U.S. 2,615,003, Oct. 21. Urea or melamine resin system containing a hydroxy alkane.

RESINS. S. O. Greenlee (to Devoe

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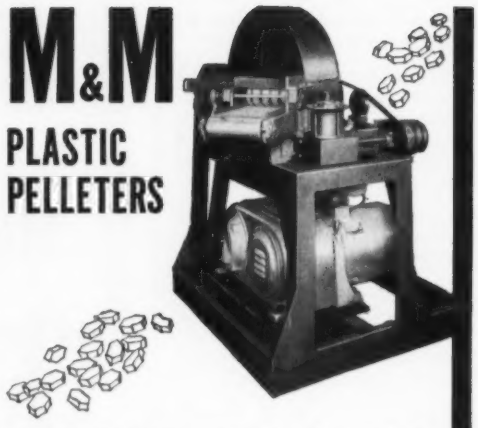

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and Raynolds). U.S. 2,615,007-8, Oct. 21. Epoxide resins.

RESINS. J. C. Robinson, Jr. (to Hercules). U.S. 2,615,011-2, Oct. 21. Vinyl esters of a stabilized rosin acid.

SILOXANES. J. M. Hersh (to Continental Oil). U.S. 2,615,033, Oct. 21. Hydrolyzates of halogen-substituted silacyclohydrocarbons.

MOLD. S. DuPree (to Wingfoot). U.S. 2,615,203, Oct. 28. Molding thermosetting resins.

MOLDED ARTICLE. I. H. Steinhardt. U.S. 2,615,269, Oct. 28. Methyl methacrylate resin containing a phosphorescent insert.

SHEET. W. W. Ulmer and L. R. Burroughs. U.S. 2,615,270, Oct. 28. Cast resin sheet.

FIBER. W. R. McClellan (to Du Pont). U.S. 2,615,784, Oct. 28. Bristles of polyethylene terephthalate.

STRIPPING FILM. J. A. Umberger (to Du Pont). U.S. 2,615,807, Oct. 28. Stripping film made from hydroxylated polymer.

ADHESIVE. G. D. Mallory and T. R. Ten Broeck (to Wingfoot). U.S. 2,615,826, Oct. 28. Vinylpyridine adhesive for bonding rubber to tire cord.

MOLDING RESIN. S. Siddigui, K. K. Sarin, and J. P. Varma (to Council of Scientific and Industrial Research, New Delhi, India). U.S. 2,615,855, Oct. 28. Shellac-cashew shell liquor resins.

RESIN. W. J. Clarke (to Bell Telephone). U.S. 2,615,857, Oct. 28. Polyethylene-polyisobutylene composition.

ORGANOSOL. D. E. Winkler (to Shell). U.S. 2,615,858, Oct. 28. Polyvinyl chloride organosol containing petroleum extract.

POLYVINYL CHLORIDE. A. Gislon (to Compagnie Francaise de Raffinage). U.S. 2,615,859, Oct. 28. Polyvinyl chloride plasticized with a chloroalkyl chlorobenzene compound.

STABILIZERS. A. R. Burgess (to Imperial Chemical). U.S. 2,615,860, Oct. 28. Resins stabilized with metal chelate compounds.

SILOXANES. P. P. Peyrot and L. J. Dumoulin (to Societe des Usines Chimiques Rhone-Poulenc). U.S. 2,615,861, Oct. 28. Reacting methyl triacetoxy silane with polysiloxane resin.

POLYMERS. S. B. McFarlane, Jr. and A. L. Miller (to Celanese). U.S. 2,615,862, Oct. 28. Reacting azelaic dihydrazide with oxalic acid.

POLYMERS. P. J. Flory (to Wingfoot). U.S. 2,615,863, Oct. 28. Polyamides.

COPOLYMERS. J. J. Giammaria (to Socony-Vacuum). U.S. 2,615,864, Oct. 28. Esterified allyl ester-polycarboxylic acid copolymers.

COPOLYMERS. A. E. Ardis (to B. F. Goodrich). U.S. 2,615,865, Oct. 28. Copolymers of vinylidine cyanide with monoolefins.

COPOLYMERS. H. Gilbert, V. L. Folt, S. J. Averill, and F. F. Miller (to B. F. Goodrich). U.S. 2,615,866-7-8-9-70-1-2-3-4-5-6-7-8-9-80. Oct. 28. Copolymers of vinylidene cyanide with vinyl esters, styrenes, vinyl chloride, vinylidene chloride, alkyd methacrylates, halogenated butadiene, diolefins, propylene, isopropenyl esters, monoolefins, and acrylic esters.

POLYMERS. E. Zerner, M. Gradsten,

and F. W. West (to Sun Chemical). U.S. 2,615,882, Oct. 28. Polymers of acrylyltriazine-aliphatic amine reaction products.

TUBING. W. A. Merck and M. W. Olson (to U.S. Rubber). U.S. 2,616,126, Nov. 4. Apparatus for extruding thermoplastic tubes.

TUBING. D. A. Barry and J. H. Pfeiffer (to Nixon Nitration). U.S. 2,616,128, Nov. 4. Extruding thermoplastic tubes.

MOLDING. F. Banz. U.S. 2,616,130, Nov. 4. High pressure device for delivering plastics.

AMPOULES. F. Meyer (to Sterling Drug). U.S. 2,616,232, Nov. 4. Making thermoplastic ampoules and filling with liquid.

CAST. J. J. Eberl (to Johnson and Johnson). U.S. 2,616,418, Nov. 4. Thermoplastic cast material.

SYRINGE. J. W. Hart (to Sterling Drug). U.S. 2,616,420, Nov. 4. Disposable plastic hypodermic syringe.

COATING. J. L. Azorlosa (to Hercules). U.S. 2,616,818, Nov. 4. Polyacrylamide coating for paper.

PANEL. L. B. Weymouth (to Briggs Manufacturing). U.S. 2,616,823, Nov. 4. Fabric-paper resin-bonded laminate.

EDGE GLUING. J. G. Meiler, C. D. Stone, and R. J. Hilton (to Plywood Research). U.S. 2,616,824, Nov. 4. Polyvinylacetate, coumarone-indene, phenolic adhesive for veneer gluing.

COPOLYMERS. J. J. Giammaria (to Socony-Vacuum). U.S. 2,616,849, Nov. 4. Copolymers of maleic anhydride with itaconic esters.

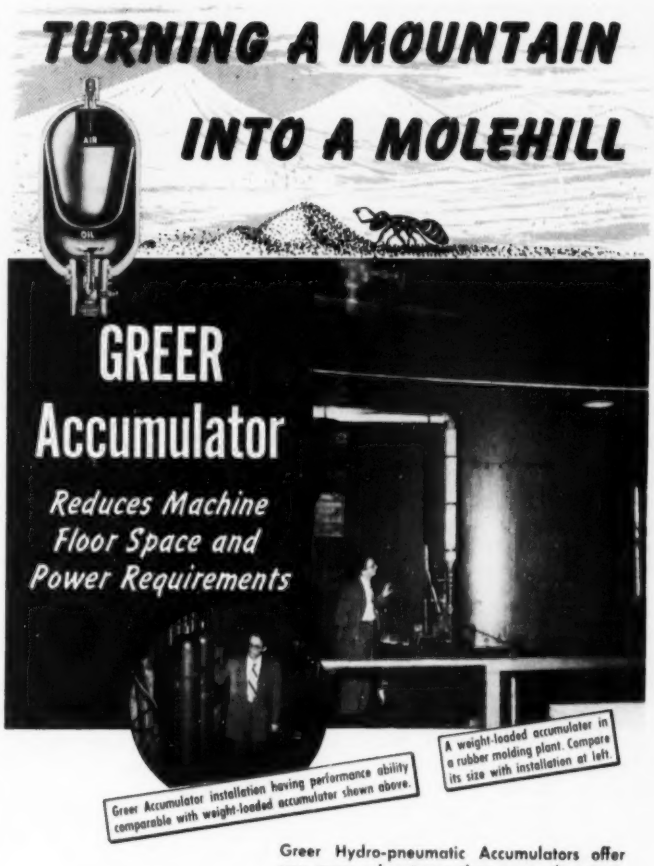
RESIN. W. E. Donaldson and A. W. Hanson (to Dow). U.S. 2,616,864, Nov. 4. Resinous compositions of monovinyl aromatic hydrocarbons and butadiene-styrene copolymers.

COPOLYMER. E. I. Valke (to E. F. Drew). U.S. 2,616,865, Nov. 4. Vinyl chloride-acetate plasticized with tetrahydrofurfuryl alcohol esters.

RESIN. M. A. Pollack. U.S. 2,616,870, Nov. 4. Polyvinyl acetal resin.

RESINS. H. Bloem and M. Stel (to Hartford National Bank). U.S. 2,616,872, Nov. 4. Method of preparing phenol-formaldehyde novolak.

RESIN. W. E. Cass (to General Electric). U.S. 2,616,873, Nov. 4. Organo-phosphorus resins.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NEW MACHINERY AND EQUIPMENT

POLISHING BELT—Designed to provide a high luster on plastics, glass, ceramics, and metal, a new coated abrasive polishing belt that uses granulated cork rather than conventional mineral grains is being produced by Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul, Minn.

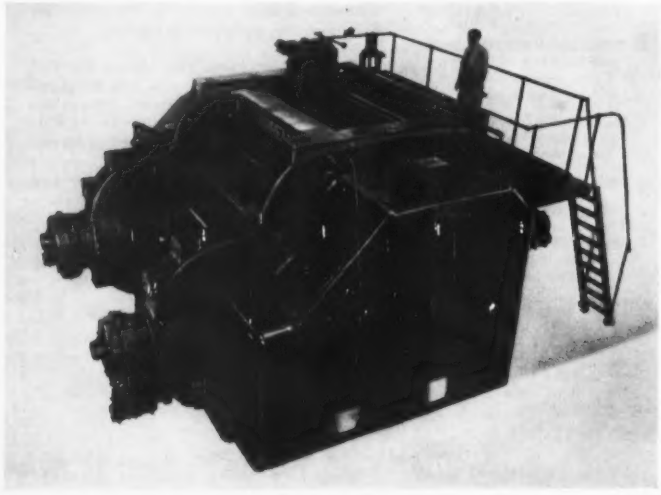
The cork surface of the belt is sized with resin combined with a polishing agent that the manufacturer claims improves the polishing action. The belt is made with a waterproof cloth backing to which the cork granules are resin bonded.

The unit is used with the regular abrasive grit sequences in the grinding and polishing processes. It is available in a single universal surface in all standard sizes for existing abrasive belt grinding and polishing equipment.

CALENDER—A precision calendering machine, built for the production of thin vinyl films, has just been announced by Farrel-Birmingham Co., Inc., Ansonia, Conn. Part of a complete train, from Banbury mixers to winder, the calender is geared for maximum production speed of 158.8 yd. per min. and is driven by a 700-hp. direct current motor.

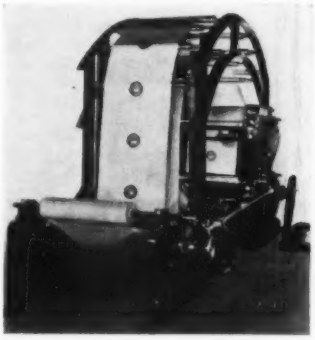
A design feature which provides operating advantages for this machine is the arrangement for material feed through the bottom roll pair. This gives the operator a direct view of the material bank, with no rear-view mirror required, and makes the first pass more accessible for feeding. The second pass can likewise be easily observed, and access is also easier to the final pass rolls for starting the material for threading through the cooling train. In addition, it is possible for the operator to stand directly underneath the top side roll where he can check the action of the pickoff roll and the embosser, which is an integral part of this calender.

Rolls of new calender are 92 in. in face length and 36 in. in diameter



PLASTIC FILM PRINTER—Specially designed for handling plastic film and cellophane, this hydraulic aniline press, known as the "Hydro-Printer" (Model X-120), has on-and-off impression controls, power impression controls, free wheeling, constantly rotating ink rollers when the press stops, dynamically and statically balanced rollers and cylinders, and, in addition, is equipped with self-aligning ball bearings.

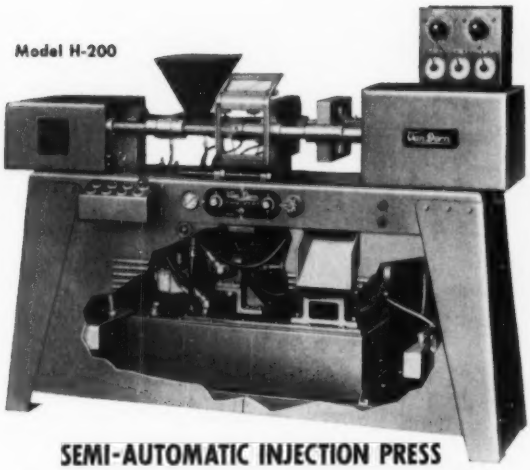
Now being manufactured by the Wolverine Paper Converting Machinery Corp., 3545 Seven Mile Rd. East, Detroit 34, Mich., the machine is equipped with top feed roller; overdrive structure, giving approximately 20 ft. of drying space from



last color to tension control; running circumferential and side register control; and impression cylinders located in total hemispherical circle, driven by single bull gear which assures wrap without pull or stretch of material.

8-OZ. INJECTION MACHINE—Most important of the improvements added in the past five years to the 8-oz. injection molding machine manufactured by Projectile & Engineering Co., Ltd, Acre St., Battersea, London, S.W. 8, England, is the new plasticizing equipment. The heating chamber has been basically redesigned, and provides homogeneous plasticizing at a high rate. Increased efficiency results from co-ordination of the many conditions favorable to thermal efficiency and streamlined flow. The chambers are provided with a very high heat transfer surface per unit volume of material, and the heating zones and relative thermocouple positions have been carefully arranged to provide a high progressive heat transfer to the material during its passage through the

Model H-200



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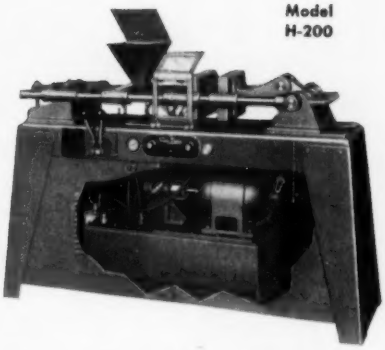
Model H-200



Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

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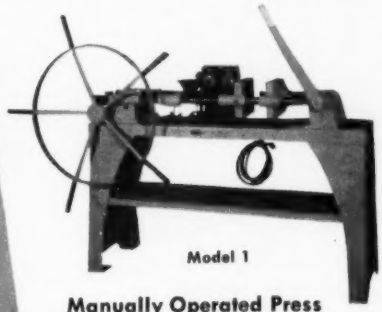

Model 1

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Plastic Grinder
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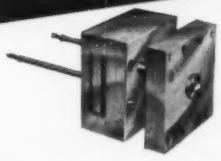
Model G-100



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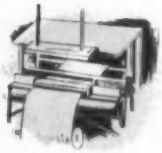
[di(2-ethylhexyl) hexahydrophthalate]



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chamber, at the same time ensuring that excessive temperatures and subsequent material decomposition do not occur at any point. Careful streamlining of the cylinder ensures not only easy color change, but also changeover to different materials without the necessity of removing the chamber.

ARC SUPPRESSORS—An arc suppressor which eliminates the possibility of damage to electrodes, dies, and costly heat-sealable materials, is produced by Thermatron Div., Radio Receptor Co., Inc., 251 W. 19 St., New York 11, N. Y. With this unit, the generator may be used without buffers. The suppressor is used in conjunction with the company's high frequency generators for heat sealing of vinyl plastics and may be set on top of the generators to save floor space. The suppressor can be used on any Thermatron electronic generator from ¼ to 20 kw. and can be added to existing units now in the field. Small dies, such as pin-point spot seals, or the largest dies the sealing unit can handle, can be accommodated. In reacting to prevent arcing, the suppressor responds in one millionth of a second.

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COATING MEASURER—Designed to measure the thickness of non-magnetic coatings on magnetic bases, and to detect pin-holes in non-conductive coatings on conductive bases, a portable battery-operated instrument has been developed by Branson Instruments, Inc., Stamford, Conn. By indicating the unbalance of a magnetic circuit, the instrument can determine the thickness of a non-magnetic coating on a substance such as iron or steel. With an accessory pin-hole detector attachment it also reveals the presence of pin holes and scratches in non-conductive coatings on conductive base materials. Both tests are made rapidly and accurately, without damage to the surface.

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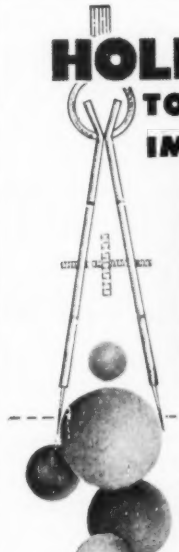

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Bibliography of Rubber Literature for 1944 and 1945."

Published in 1952 by Div. of Rubber Chemistry of the American Chemical Society, 1155 16 St. N.W., Washington 6, D.C. 452 pages. Available without charge to all members of Div. of Rubber Chemistry. Non-members should make inquiry to M. E. Lerner, Editor-In-Chief, c/o the Society.

References to all of the book, periodical, and patent literature on rubber published throughout the world in 1944 and 1945 are contained in this volume. Every original book, article, or patent, and every reprint, translation, and abstract in the English language of the book, article, or patent, is arranged for easy reference. With this edition, the bibliographies now available cover all of the rubber literature (including patents since 1940) for the period 1935-45.

"Wood Chemistry, Vols. I & II," edited by Louis E. Wist and Edwin C. Jahn.

Published in 1952 by Reinhold Publishing Corp., 330 W. 42 St., New York 36, N. Y. Vol. I, 688 pages, Vol. II, 655 pages. Price each volume $15.

Brought up to date and expanded into two separate volumes, this revised edition describes the basic chemistry underlying the important processes and products employing wood or wood cellulose. Illustrated by charts and tables, the text deals, in Vol. I, with the growth, anatomy, physical properties, and extraneous components of wood, and the components and chemistry of the cell wall.

In Vol. II, the surface properties of wood and the chemical utilization, biological decomposition, and chemical analysis of wood are discussed.

"Tablet Making," by Arthur Little and K. A. Mitchell.

Reprinted in 1951 by The Northern Publishing Co., Ltd., 37 Victoria St., Liverpool 1, England. 123 pages. Price 15 shillings.

A comprehensive description of various processes in tablet making, including mixing, granulating, drying, compressing, coloring, and coating, together with details of plant and equipment, is given. Included are 30 formulas and many illustrations.

"Chemical Engineering Catalog."

Published in 1952 by Reinhold Publishing Corp., 330 W. 42 St., New York 36, N. Y. 2075 pages. Available on loan in the United States. Foreign distribution: price $20.

The 37th (1952-53) edition of this catalog contains indices of company names, trade names, and products in the process industries. The classified index of equipment, services, and supplies contains over 15,000 company listings together with code symbols indicating the types of business.

"Metal Finishing Guidebook-Directory," edited by Nathaniel Hall.

Published in 1952 by Finishing Publications Inc., 381 Broadway, Westwood, N. J. 556 pages. Price $3.00.

Included in this 1953 directory are articles on various phases of metal finishing, such as plant engineering, mechanical surface preparation, plating solutions and operating data, and special plating procedures. Charts and tables illustrate the text, and there is a directory of suppliers and manufacturers by product classification, as well as metal finishing consultants.

"Encyclopedia Of Surface-Active Agents," by J. P. Sisley and P. J. Wood.

Published in 1952 by Chemical Publishing Co., Inc., 212 5th Ave., New York 10, N. Y. 540 pages. Price $15.00

Part I of this volume deals with the general aspects of surface-active agents—their properties, applications, and methods of manufacture. It also contains a system of classification by which every variety of the modern surface-active agent can be identified by simple symbols. Among the chemicals covered are wetting agents, detergents, penetrants, foaming compounds, emulsifiers, and dispersing agents.

Part II consists of an alphabetical listing of agents by brand name. For most of the items the following information is given: brand name; manufacturer; identical or similar products; chemical composition; class; appearance; properties; reaction; references; patents; applications; and quantities used in different applications.

Ethylene waxlike derivative—Alcowax, a low molecular weight, waxlike material derived from ethylene, is described in this 6-page folder. Nineteen suggested uses are given, among them being food packaging, paper cups and dishes, bread wraps, linings for metal containers, candles, and milk cartons and caps. Solubility information is presented, along with physical and chemical properties. Complete technical data and samples available on request. *Petrochemical Sales, Semet-Solvay Div., Allied Chemical & Dye Corp., 40 Rector St., N. Y. 6, N. Y.*

Plastics auto bodies—Construction of plastics panels for auto bodies, using fibrous glass as the reinforcement and polyester resins as the binding material, is the subject of this 28-page manual. Intended primarily to offer specific information to the individual who wishes to create an original design and who has no particular intention of building more than one automobile or component, the manual includes chapters on materials, models, molding the body, construction of the female mold, quantity production molding methods, and materials and suppliers. Line drawings illustrate the text. Available for $3.50 from *The Wilking Co., 1955 Lincoln Ave., Pasadena 3, Calif.*

Containers—Plastic capsule vials for druggists' use are described in this illustrated catalogue sheet. The vials come in three colors—clear, emerald green, and amber. Complete information as to properties, sizes, and prices are given. *Lermer Plastics, Inc., 502 South Ave., Garwood, N. J.*

Producing for the Navy—This pamphlet was prepared by the Office of Naval Material for use by businessmen who hold Navy contracts. The pamphlet does not contain all the answers, but it explains where to go or whom to see to get them. Sample subjects are contracts and letters of intent; machine tool problems; con-

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trolled materials; and packaging and shipping. *Navy Dept., Office of Information, Washington 25, D. C.*

A.C.C.L. directory—A.C.C.L. is an association of 60 independent laboratories which serve industrial, financial, and insurance companies; the medical and legal professions; universities; and government agencies. Contained in the 73-page Directory are a roster of members; the story of the association's function; statements of organization, services, specialties, etc., of various member laboratories; personnel index; geographical index of laboratories; and code of ethics. *Executive Secretary, American Council of Commercial Laboratories, Inc., 4302 East-West Highway, Washington 14, D. C.*

Lighting standards—Specifications for 18 of the most commonly employed incandescent and fluorescent industrial lighting units, as set by the Reflector & Lighting Equipment Mfrs. Standards Inst., are given in this 46-page booklet. Included are two new specifications as well as revisions and clarifications of existing specifications, and new tables of typical coefficients of utilization and light distribution curves. *RLM Standards Institute, 326 W. Madison St., Chicago 6, Ill.*

Industrial safety—Safety as sound business procedure is the theme of this 28-page illustrated booklet, which gives figures on the company's injury frequency rate over the past 25 years, and some of the methods used to attain a high degree of accident prevention. These methods include signs, bulletins, built-in devices, safety practices, and apparel safeguards. *Public Relations Dept., E. I. du Pont de Nemours & Co., Wilmington 98, Del.*

Cellulose ester—Properties of the various forms of thermoplastic cellulose ester sheet are given in this 4-page data folder. Used in the manufacture of transparent containers, envelopes, novelties, electrical insulation, and in other applications, the product is available in light, medium, and heavy gage. Properties are compared in a detailed chart as to general characteristics, moisture absorption and moisture vapor permeability, permanence, mechanical properties, optical qualities, and chemical resistance. One chart summarizes the weights, areas, and gages available, while another provides general data on formulations, colors, and finishes. *Cellulose Products Sales Div., Eastman Kodak Co., Rochester 4, N. Y.*

Protective coatings—Anti-abrasion and anti-corrosion plastic protective coatings are described in detail in this revised catalog. Repairs to conveyor belts and protection of industrial equipment against corrosion and abrasion are discussed. Other sections outline the various industries where the coatings are in use, and the types of industrial equipment to which they are especially suited. Detailed instructions are given. *Magic Chemical Co., Dept. N, 121 Crescent St., Brockton, Mass.*

Acrylic molding powder—Information and counsel for designers and molders of plastics products are contained in this new 12-page booklet on acrylic molding powder. Illustrations show applications and designs for products and uses in such fields as household appliances, automobiles, signs, lighting, and glazing. Properties discussed include the material's clarity, dimensional stability, dielectric strength, chemical resistance, impact resistance, and machinability. *Plastics Dept., Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.*

Training films—This comprehensive listing of industrial training and educational films on 1390 different subjects is now in its third edition. The 100-page "Industrial Film Bibliography" has listings indexed by both subject matter and title. Each listing gives size of film, running time, cost, source, and a paragraph of descriptive matter. Three new subject classifications are "Americanism, Socialism, Communism;" "Economics;" and "Industrial Defense." *National Metal Trades Assoc., 122 So. Michigan Ave., Chicago 3, Ill.*

Engineering services—Published for manufacturers of assembled products which require the use of fasteners, this 12-page brochure is entitled "The Milford Method." The text describes such engineering services as fastener research to determine the exact requirements in individual cases; the development of designs for the fastener and dies to produce it; laboratory testing of samples; tooling of machines for setting the fasteners; and final checking in actual production for quality and strength. Also given is complete information concerning the company's design, engineering, and manufacturing facilities in the production of tubular and split rivets, cold headed fasteners, and rivet-setting machines. *The Milford Rivet & Machine Co., 900 Bridgeport Ave., Milford, Conn.*

Plasticizer—Characteristics, general properties, solubilities, and applications of the company's plasticizer are given in this 4-page folder, along with records of performance of the material in three representative types of resins. *Technical Products Div., E. F. Drew & Co., Inc., 15 E. 26 St., New York, N. Y.*

Wood research—Description of the research services of the company in the lumber- and wood-using industries is given in this 32-page, color illustrated booklet. *Timber Engineering Co., 1319 18 St., N.W., Washington 6, D. C.*

Plastic wall tile—Waterproof protection afforded by plastic wall tile installations is emphasized in this 4-page color illustrated catalog. A wide range of colors is shown, suitable for office, institutional, and commercial applications. Information on installing procedures and tile sizes are also included. *Hachmeister-Inc., 23rd and Forbes, Pittsburgh 30, Pa.*

Printed circuits—Function, fabrication, and application of printed circuits are comprehensively outlined and described in this 8-page brochure. Applications extend to microwave plumbing, radio and TV chassis, I.F. strips, antenna filters, terminal boards, wiping switches, and flush commutators. *Photocircuits Corp., Glen Cove, N. Y.*

Heating effect of steam—A report on investigations of the heating effect of flowing superheated and saturated steam is contained in this 12-page illustrated monograph. The results of the investigations may be briefly summarized as follows: At equal pressures in the steam spaces and identical types of condensation, the heating effect of superheated steam, at the velocities and temperature drops usually encountered in prac-

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tice, is superior to the heating effect of saturated steam. The text contains a number of observations made under varying operating conditions. Dechema Monograph No. 244, Vol. 20. Price information available from *Dechema, Deutsche Gesellschaft fur chemisches Apparatewesen, Frankfort/Main, West Germany.*

Hydrocarbons—This new 12-page price list includes, in addition to six categories of hydrocarbons, knock test reference fuels; specification solvents, hydrocarbon mixtures; calibrating fluid; special fuels; and aliphatic sulfur chemicals. ***Phillips Petroleum Co., Special Products Div., Bartlesville, Okla.***

Soda fountain equipment—Specifications for the design and construction of soda and luncheonette fountains are outlined in this illustrated, 58-page booklet. The standards apply only to new equipment being manufactured. Available for 50¢ from *National Sanitation Foundation, Ann Arbor, Mich.*

Machinery—History of the company and complete description of its manufacturing activity is given in this 32-page illustrated booklet, entitled "A Lot of Things Besides Pumps." Among the products covered in detail are pumps, compressors, engines, air conditioning and refrigeration units, turbines, condensers, and construction equipment. *Worthington Corp., Harrison, N. J.*

Peroxygen treated cellulose—The treatment of cellulose and cellulose derivatives with peroxygen compounds is described in this 11-page bulletin (No. 43). Various examples of uses to which these compounds are applied can be found by consulting literature references listed in an appendix. *Buffalo Electro-Chemical Co., Inc., Station B, Buffalo 7, N. Y.*

Compacting presses—Specifications for two models of compacting presses are presented in this 4-page folder which graphically describes the exclusive mechanical features. *Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.*

Tygon paint—Comprehensive chemical-resistance charts, and an extensive chart on recommended primers and surface treatments are illustrated

in this 16-page bulletin (No. 730), which also incorporates information on Tygorust, a vinyl primer. *The United States Stoneware Co., Akron 9, Ohio.*

Nylon applications—This colorful brochure outlines the present uses and broad possibilities of nylon plastics. *United States Industries, Inc., 11 Brown St., Vassar, Mich.*

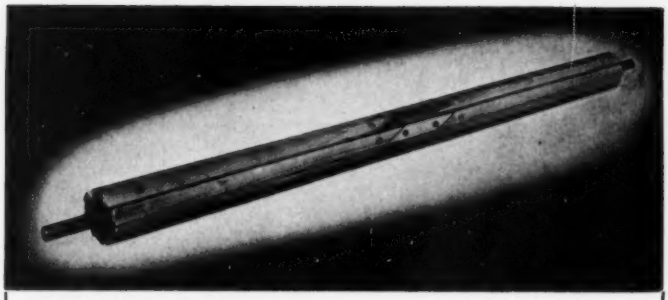
Chemical processing—This new catalog of products for use in the chemical processing industries lists such items as protective coatings, tank and pipe linings, plastics fittings, hose, pinch valves, packings, conveyor belts, and expansion joints. Chemical properties, temperature limitations, sizes, and recommended working pressures are covered. *U. S. Rubber Co., Rockefeller Center, New York 20, N. Y.*

Plastics rivets—The principle involved in plastics rivets and the applications and advantages of the product are described in this 12-page color illustrated booklet. Included are charts which give specifications of the fasteners as well as hole size recommendations. *Shakeproof Inc., Div. of Illinois Tool Works, St. Charles Rd., Elgin, Ill.*

Hydraulic power units—A hydrogen-brazed "sandwich" panel eliminates manifold piping in the hydraulic power units described in this 4-page booklet. The units are illustrated and many of the steps are described which insure that the units will be ready for immediate installation and operation. *Vickers Inc., Div. of The Sperry Corp., 1400 Oakman Blvd., Detroit 32, Mich.*

Central hydraulic systems—This illustrated 8-page bulletin (No. 900) offers data on compression molding press systems and compares weight-loaded and hydro-pneumatic accumulator systems. The text also describes how to find the required accumulator capacity for a typical press plant. *Greer Hydraulics, Inc., 454 18th St., Brooklyn 15, N. Y.*

Injection molding machines—Technical data on the company's line of injection machines are given in this 4-page descriptive bulletin. Included are 8-, 16-, and 32-oz. machines. *Meiki Co., Ltd., 1, 2-Chome Shioiricho Mizuho-ku, Nagoya, Japan.*



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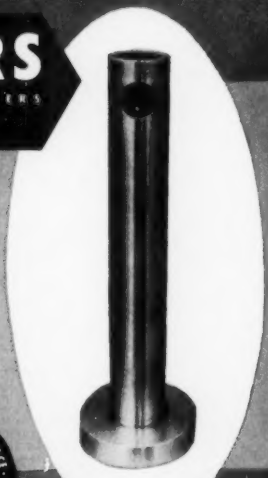

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTIC AND SYNTHETIC RESIN PRODUCTION IN
From Statistics Compiled

Materials	*Total p'd'n. first 9 mos. 1952*	*Total sales first 9 mos. 1952*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	7,593,289	7,761,578
0.003 gage and over	6,820,675	6,666,248
All other sheets, rods, and tubes	3,924,304	3,705,092
Molding, extrusion materials	41,191,382	40,766,750
Nitrocellulose:		
Sheets	3,766,222	3,220,781
Rods and tubes	603,849	741,402
Other cellulose plastics[b]	5,199,906	4,963,163
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	46,863,043	31,622,919
Adhesive	31,006,594	28,911,346
Molding and casting materials[a]	116,714,067	104,807,965
Protective coatings (modified and unmodified except by rosin)	19,057,154	16,791,835
Miscellaneous uses	44,835,986	41,239,545
UREA AND MELAMINE RESINS:		
Adhesives	56,826,851	56,433,176
Textile treating resins	24,013,594	23,108,271
Paper-treating resins	16,045,241	16,010,465
Protective coatings, modified and unmodified	16,243,415	13,227,246
Miscellaneous uses, including laminating and molding[c]	38,800,250	33,151,884
STYRENE RESINS:		
Molding materials[a]	180,668,709	161,263,091
Protective coatings, modified and unmodified	50,307,008	49,878,575
Miscellaneous uses	50,284,664	44,058,855
VINYL RESINS:[d] Total	310,329,609	289,789,028
Sheeting and film (resin content)[e]		114,090,564
Adhesives (resin content)		12,184,643
Textile and paper-treating resins (resin content)[f]		30,502,765
Molding and extrusion materials (resin content)		98,180,485
Protective coatings (resin content)		14,865,727
Miscellaneous uses (resin content		21,964,844
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	127,657,840	128,225,246
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a,g]	74,902,760	70,796,126
Protective coatings[h]	35,690,149	36,438,881
All other uses[i]	72,949,145	71,707,743

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [c] Includes sheets, rods, and tubes, and molding and extrusion materials. [d] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [e] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

POUNDS[a] FOR AUGUST, 1952, AND SEPTEMBER, 1952 by U. S. Tariff Commission

August 1952		*September 1952*	
Production	*Sales*	*Production*	*Sales*
770,706	921,044	917,747	1,043,681
836,738	852,899	927,287	848,277
391,005	369,131	377,681	392,697
4,865,674	4,834,932	6,109,077	5,981,209
384,933	356,821	491,657	365,258
53,907	95,683	89,533	103,950
404,180	440,606	303,445	421,538
4,973,470	3,837,772	6,353,318	4,370,189
3,923,644	3,712,822	4,322,034	3,978,967
12,851,592	13,220,584	14,429,401	14,817,234
2,075,199	1,882,321	1,840,596	1,787,163
5,100,885	4,923,560	5,873,574	5,130,383
7,213,590	6,886,324	6,507,677	6,489,883
2,889,126	3,042,902	3,057,377	2,739,505
1,909,333	2,006,836	1,856,625	2,002,860
1,666,693	1,464,912	2,299,630	2,028,657
4,656,865	5,301,955	5,520,118	5,918,017
16,508,487	20,529,611	21,655,304	24,128,684
6,323,509	5,061,197	6,482,693	5,276,155
5,498,856	5,890,270	5,828,576	5,783,293
29,582,479	35,647,625	32,763,817	37,319,784
	13,281,670		13,938,616
	1,612,148		1,774,640
	3,902,520		3,713,751
	11,465,557		12,662,599
	2,331,275		1,963,431
	3,054,455		3,266,747
13,680,397	13,333,041	14,546,175	15,365,001
8,384,334	8,119,663	8,934,078	8,214,656
1,490,787	1,552,294	2,055,590	2,628,216
9,483,556	8,656,851	9,143,900	9,469,305

tion are given. [a] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, resin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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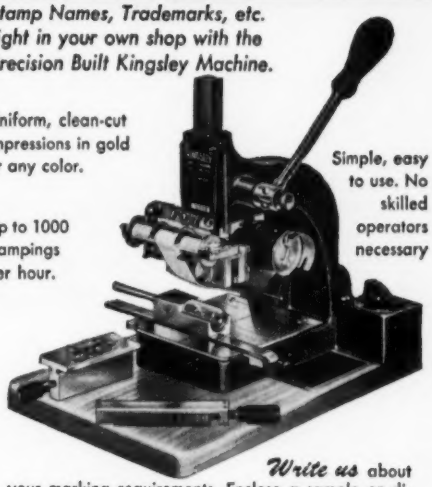

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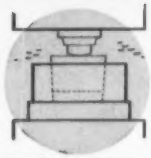
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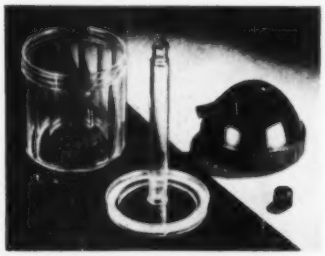
A STYRENE dispenser made by Wecolite Co., New York, N. Y., is available in two sizes for dispensing ketchup, mustard, salad dressing, etc. Each unit consists of a styrene container, plunger and tube, screw-on cap, and a small friction-fitting cap for the tube. The gasket on the plunger is polyethylene. The screw-on cap is actually an assembly of three pieces: a cap, a trigger, and a false bottom under the trigger to keep the contents away from the trigger mechanism.

The container is filled and the plunger inserted above the contents. Once the screw cap is on, pressure on the trigger forces the plunger down into the jar and the contents up and out of the tube. Each time the trigger is pressed, the plunger moves down about 1/16 in. against the contents.

The body of the dispenser and the plunger are molded of clear styrene; the cap and trigger are molded of colored styrene. Dispensers are sold either separately or in a set consisting of one large dispenser, two small dispensers, and a matching styrene tray.


Styrene parts include jar, plunger, cover, and cap; gasket is polyethylene

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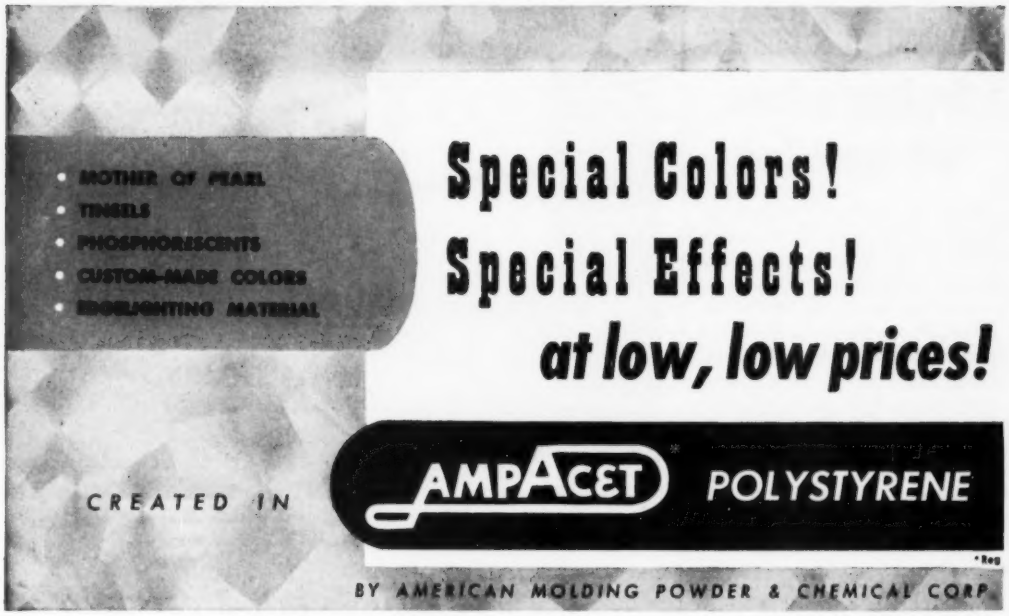

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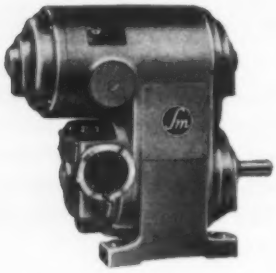

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The assortment of molded-in panel colors complement the trim of homes, stores, and offices. Standard colors are lemon yellow, wheat, sea green, flamingo red, and sky blue. Because of the molded-in color, repainting is never required unless a decorative change is desired.

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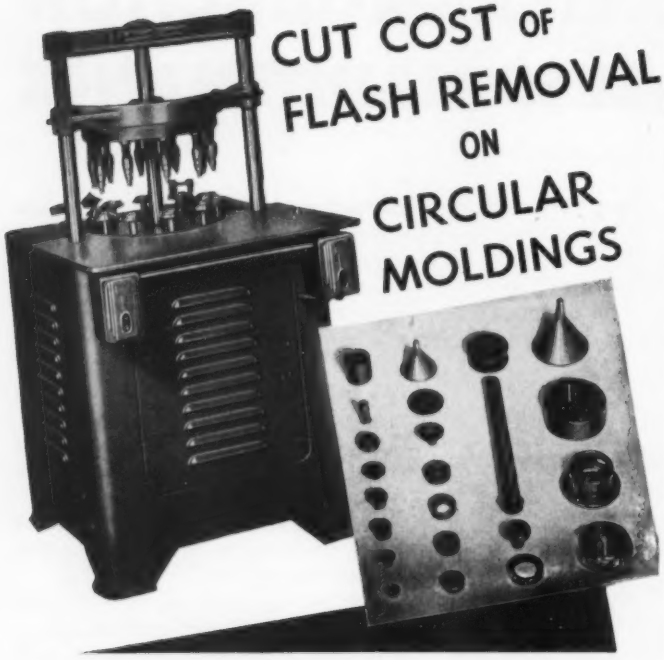
Controls—Controls on front of cabinet include electrode height adjusting knob, plate ammeter, grid meter, grid adjustment knob, timer, and main circuit breaker.

Construction—Heavy gauge aluminum cabinet contains built-in material-heating compartment with electrode and preform handling tray.

Dimensions and Weight—21" wide, 24" deep, 53¾" high. Weight: 925 lbs. gross, 800 lbs. net.

The **GIRDLER** Corporation

Thermex Division



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You can turn out 20 to 60 perfectly-deflashed circular or cylindrical moldings every minute with . . .

The New NASH "103"

AUTOMATIC FLASH LATHE

Hand flash removal slows down production and adds to the cost of your moldings. The Nash "103" lathe pays for itself quickly with *more and better work at lower cost per minute.*

BUILT THE NASH WAY THROUGHOUT

The Nash "103" confines its operation to the flash area exclusively, maintaining the surface appearance of molded pieces. It has 10 spindles and can deflash moldings up to 4½" diameter when all spindles are used, and up to 6" diameter when alternate spindles are employed. Height adjustments vary from nothing to 8". All necessary adjustments of spindle speeds and heights are easily made.

Write for further details. We also build the Nash "116" Rotary Edger for Plastic Dinnerware.

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Refrigerator Chamber

DEEP drawing techniques developed by Durable Formed Products, Inc., New York, N. Y. make possible the all-plastic refrigerator food chamber used in the P. S. Inc., Jr. Refrigerator.

The food chamber, 12 by 12 by 12¼ in., is drawn from thin gage Royalite, a product of U. S. Rubber Co. Royalite is reported to be ideal for this application because of its resistance to abrasion and acids. A high-impact material, it will not shatter, is waterproof, odorless, non-corrosive, and, most important of all, is a good thermal insulator.

An inexpensive wooden mold is used; this makes design changes possible with greater frequency. Because of the low cost of a wooden mold, low tooling costs are feasible where small quantities are desired.

The outer housing is constructed of galvanized metal. Fibrous glass insulation is placed between the Royalite food chamber and the housing.

The refrigerator manufacturer reports low fabrication costs since the inner compartment can be easily machined. In addition, its light weight makes it easier to handle. Consideration is now being given to the possibility of producing the door liner, storage and motor compartments, and exterior of the product in the same manner and of the same material.

New Junior refrigerator and, at bottom, chamber of formed sheet copolymer

Toys of many types can be sculptured in multi-colors with use of simple tools

Modeling Plastisol

ARTIST'S vinyl modeling material, called Pyrocon, a formulation of Vinylite plastigels, has been developed and is now being placed on the market by General Glaze Corp., Baltimore, Md.

Pyrocon is non-sticky and soft enough for even children to handle. It is workable by hand or with any type of modeling tool. The work is preferably done on a table or other flat, hard surface.

The plastigel material is safe to handle, will remain pliant without moistening, has long shelf life, and can be used over and over again if not baked. Pyrocon does not crumble and will not stick to furniture, upholstery, rugs, or clothes. If an extremely firm material is desired, Pyrocon can be cooled by refrigeration to any degree of consistency, prior to forming and shaping.

Once formed into a desired shape, the sculpture can be preserved in hard, resilient, washable form by simply baking it in an ordinary kitchen oven. A temperature of 350° F. is required for about 15 minutes.

Pyrocon is stronger and less fragile after baking than kiln-fired clay or dried plaster cast. Armatures of wire, pipe cleaners, or other supports can be baked inside the material without danger of fracture. There is practically no shrinkage in baking and no danger from explosions or cracking as with kiln-fired clay. After baking, Pyrocon resists abrasion, moisture, and most chemicals.

The vinyl plastigels take perfect impressions from molds, and can be cast from hardened molds made of the same material.

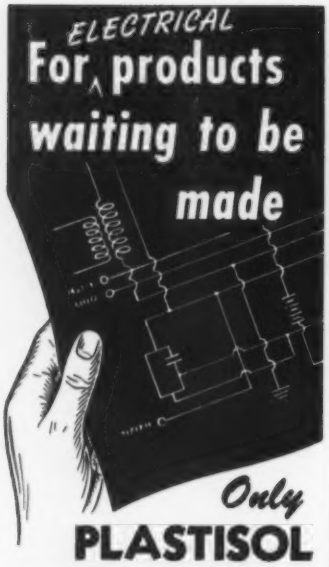
Rolled out in thin sheets with sculpturing tools, fragile-looking pieces, such as finely detailed flower petals, can be produced which retain their form indefinitely after baking. Other new techniques which this art medium makes available to the creative artist include extrusion with simple equipment in the form of fine filaments or relatively thick tubes.

When baked, fragile flower petals formed from sheets are firm yet resilient

Almost any color, shade, tint or mottled effect can be reproduced in the modeling material by kneading together portions of the proper colors. Pyrocon is available in black, white, red, yellow, blue, green, and terra cotta.

Special blends of varying consistency for greater hardness or flexibility are being made available for use by commercial designers and serious sculptors.

Modeling material can be extruded by hand in fine filaments or thick tubes



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- Good flame resistance
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Whatever you manufacture, from spaghetti wiring to circuit-breaker panels, Stanley chemists can formulate a vinyl plastisol to meet your most exacting insulation requirements. For specific information write *today* to the Stanley Chemical Co., 72 Berlin St., East Berlin, Conn.

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STANLEY CHEMICAL

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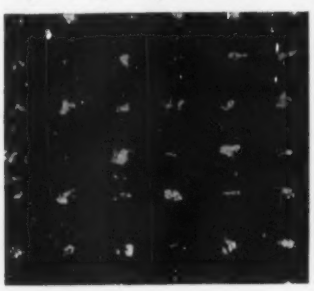
Silicone-treated cover has high heat resistance and a smooth surface slip

Ironing Board Cover

HIGH heat resistance of silicone coated cloth is being utilized by Magla Products, Newark, N.J., to produce ironing board covers that resist twice the amount of heat as conventional asbestos and cloth covers and enable housewives to reduce ironing time considerably. The Magla silicone cover is made by applying 35% silicone polymer water emulsion, supplied by General Electric Co., to a porous cotton material by means of a knife-coating machine. Cloth thus treated has an extremely easy surface slip and a permanently dry ironing surface since it is non-absorbent. Porosity of the cloth is emphasized by the thousands of tiny air vents which permit rapid evaporation of steam. The silicone cover is color fast and waterproof, and is cleaned by simply wiping with a damp cloth.

Porosity of cloth, magnified 12 times, permits rapid evaporation of steam



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Vinyl spacers (shown in right hand) follow each stick of dynamite down pipe

Dynamite Spacers

CONSUMPTION of dynamite in underwater blasting operations is reported to be reduced 30% by tubular vinyl spacers extruded by Irvington Varnish & Insulator Co., Irvington, N.J.

The spacer is simply a straight hollow extrusion, with no close tolerance, that is cut into 12-in. lengths.

Use tests have shown that the effectiveness of the spacer is predicated on the nature of the dynamite which explodes and creates breakage in all directions. By separating the sticks of dynamite within the limits of this effective breakage range, the same results can be accomplished with the use of less explosive material without the need for end-to-end dynamite stacking.

Spacers were originally developed for underwater blasting by Maule Industries, Miami Beach, Fla., which developed the process of driving a plugged-end pipe through rock, sand, and water, to a depth of 22 feet. The plug is knocked out and the water enters the pipe. About three or four sticks of dynamite are dropped to the bottom of the hole with a spacer separating each additional stick of dynamite until the hole is filled.

The water which fills the spacer is non-compressible. It is this property of the water which transmits the initial shock caused by the prime explosion to continue the detonation down the line.

Inspection Tray

SAMPLING of precision parts for quality control is facilitated by the use of multi-tray inspection sets being molded of Boltaron copolymer sheet by Durable Formed Products, Inc., New York, N.Y. The copolymer sheet, produced by Bolta Products, Inc., Lawrence, Mass., brings to this application those properties which are necessary to insure the proper care and handling of critical precision parts during control procedures; the material is non-contaminating, resists oils, alkalies, and solvents; and withstands variable temperatures. It is, in addition, light weight, non-chipping, easy to clean, and capable of withstanding rough usage.

Components of the Durable inspection tray set are three identical "insert trays" formed of 0.062 copolymer sheeting and measuring 4½ by 4¼ by 1 inch. These trays fit into a larger "pick-up tray" of 0.093 sheeting which is 11 by 9¾ by 1¼ inches. During quality control procedures, the inspector is able to spot check the machined parts for critical dimensions and segregate the rejects into one of the insert trays. This reject tray can then be removed from the unit and sent on to the laboratory for more extensive and accurate testing.

The sets are available in a variety of standard colors for use in plants producing such precision parts as aircraft rivets, machine screws, electrical tube pins, or any other critical part. They offer a price advantage over comparable stainless steel trays as a result of using a special molding process which also allows for variation of size for special orders.

Set formed of copolymer sheet facilitates sampling of precision parts

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Cabflex DDA	*didecyl adipate* New Low Temperature Diester with Low Volatility

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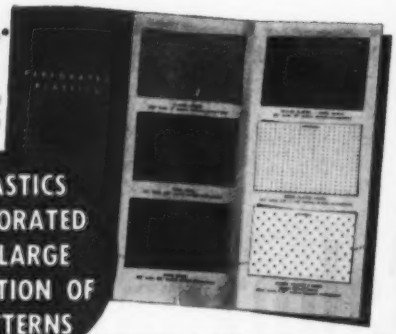

(Folder showing actual perforated samples)

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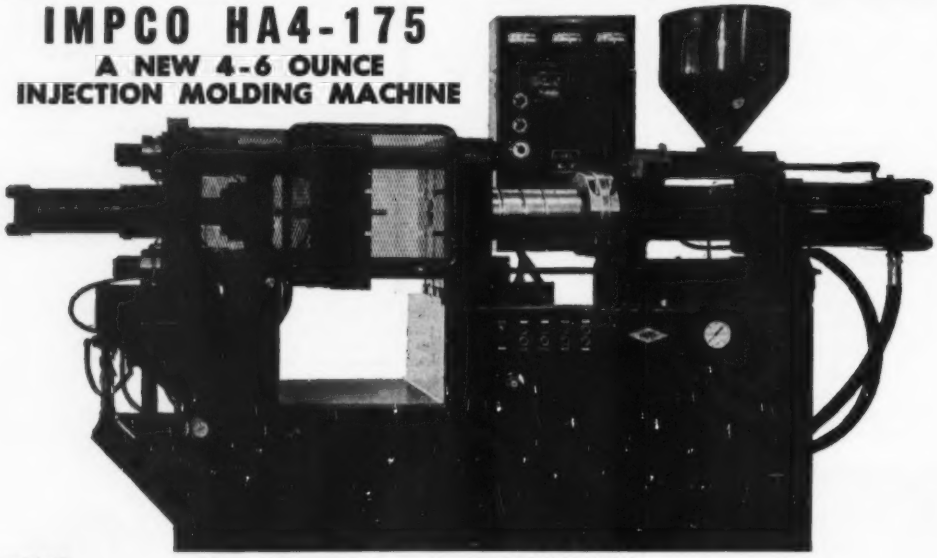

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S. P. I. Program

(*Continued from p. 83*)

P. M. Elliott, Naugatuck Chemical Div.; U. S. Rubber Co.; Dr. E. W. Moffet, Pittsburgh Plate Glass Co.; Dr. Harold A. Hoppens, Plaskon Div., Libbey-Owens-Ford Glass Co.; Deno Laganis, Reichhold Chemicals, Inc.; William E. Wirsch, The Resinous Products Div., Rohm & Haas Co.; J. E. Carey, Shell Chemical Corp.

3:30 p.m.—Contact Period

Representatives of resin, filler, and reinforcement manufacturers, mold and machinery manufacturers, designers or consultants and government representatives to remain in individual rooms.

7:30 p. m.—Annual Banquet

Toastmaster: Harold B. Freeman, American Cyanamid Co.

Friday, February 20

9:00 a.m.—Simultaneous Technical Sessions

"Equipment, Presses, and Molds" —A Forum.

Moderator: Milton Brucker, Zenith Plastics Co.

Recording Secretary: Clare E. Bacon, Owens-Corning Fiberglas Corp.

Representatives on Panel: Robert J. Brinkema, R. J. Brinkema Co.; R. W. Powell, The Hydraulic Press Mfg. Co.; Charles Jones, Structurlite Plastics Corp.; W. Brandt Goldsworthy, Industrial Plastics Corp.; W. Burdette Wilkins, Consultant; John C. Reib, Shaw Industries, Inc.; Irving Green, Zenith Plastics Co.; C. F. Kreiser, Edwin L. Wiegand Co.; Jack Cuming, M. A. Cuming & Co., Inc.

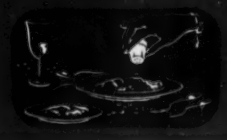
"New Developments in Fibrous Reinforcements"—A Forum.

Moderator: W. Brandt Goldsworthy, Industrial Plastics Corp.

Recording Secretary: Clare E. Bacon, Owens-Corning Fiberglas Corp.

Representatives on Panel: William E. Braham, Zenith Plastics Co.; Dr. J. H. Plummer, Glass Fibers, Inc.; Frank W. Dennen, Owens-Corning Fiberglas Corp.; Herbert A. Fox, Libbey-Owens-Ford Glass Co.; Harold S. Miller, United Merchants Industrial Fabrics; E. H. Decker, Hess, Goldsmith & Co.; P. Modigliani

Why GITS-ware uses Kum-Kleen labels...



Kum-Kleen LABELS HELP SELL... There's an eye-catching Kum-Kleen informative label on every Gits-Ware Plastic shaker or spicer...right at the point-of-sale where *extra salespower* really counts!

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9:00 a.m.—Simultaneous Sessions on Management Problems

Presiding Officer: Roger B. White, The Glastic Corp.

Recording Secretary: Leonard S. Meyer, Western Products, Inc.

"Proprietary Item Sales," W. L. Cone, Plastics Manufacturing Co.

"Custom Molding Sales," F. Reed Estabrook, Northern Industrial Chemical Co.

"Military Item Sales," Chase Donaldson, Consulting Engineer, Universal Moulded Products Corp.

"Development Contract Sales," Robert J. Brinkema, R. J. Brinkema Co.

12:30 p.m.—Luncheon

Presiding: Richard Malamphy, Naugatuck Chemical Div., U. S. Rubber Co.

Principal Speaker: I. M. Scott, Winner Manufacturing Co.

2:30 p.m. — Technical and Management Forum. Registrants will have the opportunity of posing questions to a panel made up of speakers at the three-day sessions.

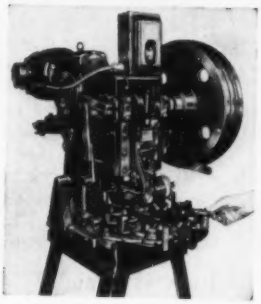
Moderator: Robert J. Brinkema, R. J. Brinkema Co.

Recording Secretary: Samuel S. Oleesky, Reinforced Plastic Consultants and Engineers.

Frank I. Bennett, Bakelite Co.; Harold M. Day, American Cyanamid Co.; E. H. Decker, Hess, Goldsmith & Co., Inc.; Frank W. Dennen, Owens-Corning Fiberglas Corp.; P. M. Elliott Naugatuck Chem. Div., U. S. Rubber Co.; A. Fox, Libbey-Owens-Ford Glass Co.; W. Brandt Goldsworthy, Industrial Plastics Corp.; Donald M. Hatch, Jr., Hughes Aircraft Co.; Charles Jones, Structurlite Plastics Corp.; James Lunn, Lunn Laminates, Inc.; Leonard S. Meyer, Western Products, Inc.; I. M. Scott, Winner Manufacturing Co.; Roger B. White, The Glastic Corp.; W. Burdette Wilkins, Consultant; William E. Wirsch, The Resinous Products Div., Rohm & Haas Co.

By title only: "Development of Fabrication Techniques for High Temperature Resistant Structural Components," Donald M. Hatch, Jr., Hughes Aircraft Co.

HOT STAMP



The Acromark No. 2A Hot Stamping Press can be set for marking speeds to suit either hand or mechanical feeds. The dial feed shown is hand loaded but automatically ejected. Hot stamping speed (in color) is about 5-8 units per minute. Automatic feed can double production if shape of plastic part lends itself to mechanical feeding.

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Glass Fabrics, Part 1

(*Continued from pp. 84-6*)

ally woven from either single or twisted yarns instead of the plied yarns. A typical staple yarn is 40/2, which indicates that the base yarn is 40 and takes 4000 yards to weigh one pound. It also indicates that it is a 2-ply yarn, which means that the twisted yarn is 4000 divided by 2, which equals approximately 2000 yards per pound.

Fabric Construction

A molder or laminator has many factors to take into consideration when selecting a fabric, but there is usually one outstanding requirement peculiar to the particular application at hand. The properties may be listed as follows: 1) breaking strength; 2) thickness; 3) weight; 4) porosity; 5) pliability; and 6) cost. There are other factors to be taken into consideration after the cloth has been made into a laminate, but these have to be determined by the molder making the selection.

The above list is not in order of importance; importance will vary according to the application. These properties are determined by various construction details and each contributes to one or more of the others.

Thread count—The threads running parallel to the length of the cloth are known as "warp" threads and are sometimes called "ends." The threads running across the width of the cloth and perpendicular to the warp are known as "filling" threads. They are also referred to as "picks" and "weft." Thread count is expressed by the number of ends and picks per inch. For example, the standard 164 cloth is a 20- by 18-thread count, which indicates that there are 20 warp threads per in. and 18 filling threads per inch. It should be noted that the number of warp threads is always given first, followed by the filling threads.

It is obvious that the more threads per in., the higher the breaking strength. The breaking strength is a measure of tensile and is expressed in p.s.i. It is determined in both the warp and filling direction. However, the breaking strength is not in direct proportion to the number of ends and picks. The warp and filling threads have a shearing action upon each other. In the case of a fabric with about the same number of threads in each direction, the higher the thread count, the lower the breaking strength on a weight basis, but the actual strength is usually greater.

The perfect reinforcement would be one using warp threads only but, of course, it would no longer be a woven fabric. There are limitations as a fabric becomes too sleazy beyond a certain point. The thread count naturally affects the porosity as well as the pliability. The higher the thread count, the less pliable the fabric becomes. The weaving cost of a fabric is based directly on the number of filling threads per in. and the lowest cost on a per weight basis can be obtained by producing a fabric with the highest warp to lowest filling ratio. Thickness of a fabric is generally determined by yarn size but can be increased by increasing the number of threads until they overcrowd each other.

Yarn—The yarn size primarily controls the thickness of a fabric and obviously the higher the ply of the yarn the thicker the fabric. As for breaking strength, weight, porosity,

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and pliability, the effect which yarn size has is proportional to the thread count.

The size and type of yarn used contributes largely to the cost of a fabric. The larger the size of the yarn, the lower the thread count to maintain the same weight and consequently the lower the weaving cost. If the same thread count is maintained, a heavier fabric is produced, at approximately the same weaving cost. In both instances, the cost is lower on a per weight basis.

However, there are limitations to the size of yarns that can be used. When the yarn becomes too coarse, the percent of resin pickup drops off considerably and is hard to control; there is a tendency for delamination; it is difficult to maintain tolerances; and poor machinability results.

Maximum strength is obtained from a laminate made up of a thin fabric containing a large number of plies. However, the cost of the fabric and fabrication is considerably higher.

There is a considerable spread between the cost of "D," "E," and "G" fibers yarns and, of course, this is directly reflected in the cost of fabrics woven from these yarns. For example, the type 128 fabric woven from "D" yarns sells for approximately $2.15 per pound; out of "E" yarns this same type fabric sells for about $1.80 per pound; and out of "G" yarns this fabric sells for $1.40 per pound.

The question naturally arises as to what advantages are derived from the more expensive fibers. Actually there are practically no "D" type fabrics used in the laminating field. One exception is an electrical application using a silicone type resin in which the requirements are very rigid. It is claimed that the "D" type fibers give a slightly higher dielectric strength and lower power factor.

The type "E" yarns were developed long before the "G" fibers and consequently fabrics were first constructed from these yarns. The various Government Services adapted these fabrics and wrote their specifications to include them. The newer "G" type fabrics have proved satisfactory for practically every application but it naturally takes time to rewrite all specifications to include these fabrics. In a matter of time, fabrics woven from the "G" type yarns should practically replace all of the fabrics woven from the higher priced yarns. Of course, should the new "K" yarns prove satisfactory, they will begin to replace the "G."

Fabrics woven from staple yarns have been used only in limited quantities in the past, due mainly to difficulty in handling, considerably less strength than the continuous filament yarn, and cost. The advantage offered by the staple fabrics are higher resin pickup, greater bulk, better bond, and machinability. One of the yarn producers is exerting considerable effort to improve the staple yarns and there are several promising applications in which the bulking factor shows great promise.

Types of Weaves

Type of weave should be taken into consideration as the right selection can often make the laminator's job much easier. The most common types of weaves will be discussed individually as to how they affect the properties of a fabric.

Plain Weave—The plain weave is the simplest and most commonly used. In this type of weave, the warp and filling threads cross alternatingly. Plain woven fabrics are generally the least pliable, but they are also the most stable. This stability permits the fabric to be woven with a fair degree of porosity without too much sleaziness. In this type there is a maximum number of interlacings and, consequently, maximum shearing action. For this reason, a plain woven fabric has the minimum breaking strength on a weight basis. When coarse yarns are used, this type of weave produces a wavy fabric. These fabrics can be woven with low thread counts.

Basket Weave—In this type of weave, two or more warp threads cross alternately with two or more filling threads. The basket weave is less stable than the plain weave but produces a flatter and stronger fabric. It is also a more pliable fabric than the plain weave and a certain degree of porosity is maintained without too much sleaziness, but not as much as the plain weave.

Crowfoot Weave—This fabric is so named because the weaving pattern when laid out on cloth design paper resembles the imprint of a crow's foot. In this type of weave there is a 3 by 1 interlacing. That is, a filling thread floats over three warp threads and then under one. This type of fab-

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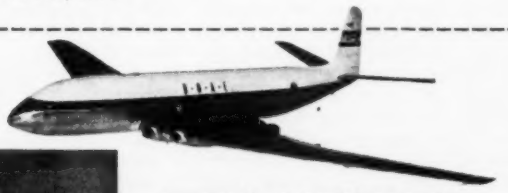

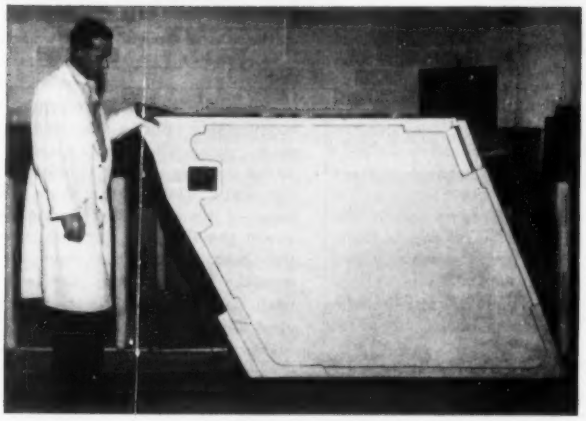

Shown above is a single curved wing panel used as a primary structure in a high performance Chance-Vought Aircraft jet. This type of construction is typical of Redux-bonded assemblies comprising metal-to-metal and metal to end-grain wood adhesive bonds.

Shown below is a section of a typical sandwich construction utilizing thick facings and end-grain wood core, bonded together with a structural adhesive. The internal doubler at the right illustrates how local reinforcements may be added and still retain flush contour.

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➡ REPRINTS OF PUBLISHED PAPERS BY DR. DE BRUYNE ON THE "REDUX" PROCESS and related data sheets have been assembled in a special reference file folder to serve as a preliminary guide to aircraft engineers in evaluating and using the "Redux" bonding process. Complete engineering assistance and information on the use of the process are available from Ciba.

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MP-1

ric looks different on one side than the other and this is known in the textile trade as warp effect and filling effect. Fabrics with this weave are more pliable than either the plain or basket weave and, consequently, are easier to form around curves. Crowfoot weave is also a flatter fabric and has a higher breaking strength due to the decrease in the number of interlacings which reduces the shearing action of the threads. It is difficult to maintain porosity without encountering too much sleaziness.

Eight Harness Satin—A fabric with this type of weave has a 7 by 1 interlacing in which a filling thread floats over seven warp threads and then under one. Like the crowfoot weave, it also is different on one side than the other due to warp and filling effect. This weave is more pliable than any of the others and is especially adaptable where it is necessary to form around compound curves, such as on radomes. It is also flatter and gives greater strength. Porosity cannot be maintained because of excessive sleaziness. For this reason, these fabrics must generally be woven with high thread counts. Where ultimate strength is required, a very high thread count can be obtained by crowding the ends.

Leno Weave—A leno weave is a locking type weave in which two or more warp threads cross over each other and interlace with one or more filling threads. It is used primarily to produce a very open type fabric without excessive sleaziness. It requires special leno attachments on a loom.

Mock Leno Weave—A mock leno weave is exactly what the name implies. It is an open type weave that resembles a leno and is accomplished by a system of interlacings that draws a group of threads together and leaves a space between the next group. The warp threads do not actually cross each other as in a real leno and, therefore, no special attachments are required for the loom. This type of weave is generally used when a high thread count is required for strength and at the same time the fabric must remain porous.

Finishes

Glass fabrics are very seldom used in the loom state or what the textile industry terms "in the greige." The cloth as it comes from the loom contains the binder or sizing which was originally applied to the yarn so that it would withstand the throwing and weaving operations without excessive damage. This sizing is made from starch and oils and is not compatible with any of the laminating resins. One of the primary purposes of each of the finishes is to remove this sizing.

Compatible Sizing

The question naturally arises as to why not use a sizing that is compatible with the resins. The yarn producers have and still are exerting considerable effort to discover just such a sizing. The yarn is drawn out of the bushing at over 10,000 ft. per min. and it is evident that there is no lapse of time to allow drying between the time the filament leaves the bushing and the time it is wound. Consequently, the sizing must be one that will not cake the glass sliver on the winding tube.

Each finish will be discussed according to its purpose and place in the laminating field.

Heat Treatment—This treatment is also identified as #111, #V11, and

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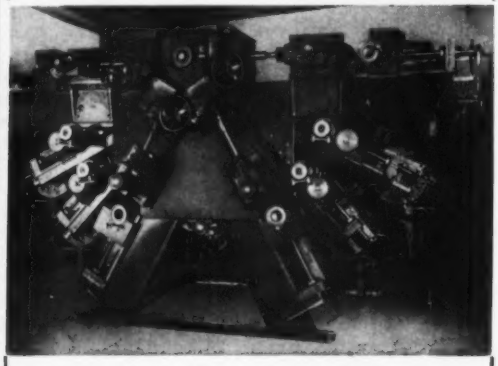

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#V11A. It consists of partially removing the binder content from the fabric and is accomplished by passing the cloth through an oven at a temperature of approximately 600° F. The #111 and #V11 reduces the binder content to from 0.5% to 1%; the #V11-A reduces the binder content to less than 0.5% and volatile content to less than 0.05%. Cloth turns a tan color after treatment. These treatments are widely used for high pressure lamination with melamine or phenolic resins and in conjunction with low pressure resins for a few special applications.

Heat Cleaning—This treatment is identified as #112 and #V12. The purpose is to remove all binder from the cloth and it can be accomplished by several different processes. In the continuous process the fabric is first chemically treated and is then passed through an oven. The batch process consists of placing rolls of fabric in a stationary type oven and soaking at temperatures from 500 to 600° F. for periods varying from 50 to 60 hrs. depending on the weight of the fabric. The heat cleaned cloth is white in color. This treatment is a prerequisite for most of the finishes used in conjunction with the low pressure resins. It is also used where maximum electrical and physical properties are required with high pressure silicone resins.

#114, #136, Garan, and Volan "A"—These finishes are applied to heat cleaned fabrics and were primarily developed to improve the wet strength characteristics of laminates. They create a better bond between fabric and resin, which also improves dry strength. Fabrics with these finishes are easier to wet out.

The #114 and Volan "A" are chrome salt finishes and most of the others are classified generally as silane finishes. Finish #114 was the first developed and it is generally accepted that all the newer ones give improved characteristics.

Washing—The binder applied to staple yarns has a high percentage of oil and to heat clean a fabric woven from these yarns presents a fire hazard. To eliminate this hazard, staple fabrics are cleaned by washing.

There is also considerable effort being exerted to develop a satisfactory process for cleaning fabrics woven from continuous filament yarns by washing.—END

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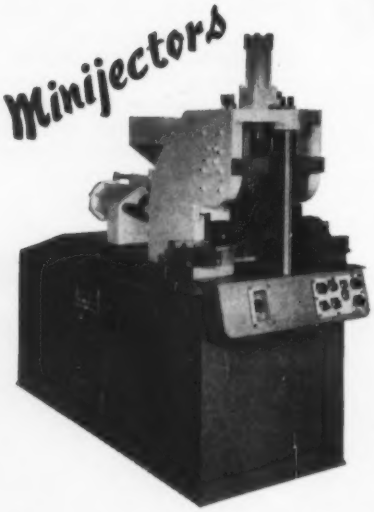

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Glass Fabrics, Part 2

(*Continued from pp. 86-7*)

wide acceptance and additional constructions had been developed to meet engineering demands.

Today there aren't any applications for reinforcement that require the use of fabrics made from the 450's type yarns, and only those demanding the ultimate in properties are left for the 225's type fabrics. During the past year fabrics made from a 75's type filament have been developed and testing is now going on. It is fully expected that these fabrics will also find a place in the reinforcement field.

Treatments

In the early days many projects had to be dropped due to failure of glass laminates to meet requirements. This has been overcome today largely through the advancement in treatments for glass fabrics. The major purpose of the various treatments given to glass cloth for laminating is to retain in the laminate the maximum of the laminate dry strengths under wet conditions, without, of course, detracting from the bond strength or other characteristics. Until recently the so-called 114 finish was the only one available to do this job. Now several new finishes are commercially available which will retain a much higher percentage of dry strength. The improvement in finishes has extended the use of glass fabric laminates into much broader fields. (See Table 2.)

Complications of Selections

Today the perplexed reinforced plastics molding engineer who wants to get the best and most economical fabric for a job is faced with complications.

1) He reads and hears about the older fabrics which appear in specification, and which, because they are specified, he feels must be used, or at least will provide him with maximum in properties.

2) He would like to use the newer, less expensive materials in the interest of making more money, or of being more competitive. He is not always sure, however, that these fabrics will meet requirements or that even if they do, that they will be accepted.

3) Oftentimes there is available

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from the weaving group a variety of constructions adaptable to the same end use. These constructions bear the individual designations of the manufacturers. Unfamiliarity of the molder with the wide range of fabric nomenclature and the detail of constructions, has tended to generate confusion in the selection of the proper fabric.

4) Weavers are continually seeking to modify existing constructions to reduce costs. This, of course, is desirable but leads to complications because the original fabric is usually still listed as available.

5) Some plastics engineers will be unable for one reason or another to get desired results from existing constructions. They check all the contributing factors as closely as possible. Many times the only unexplainable factor is the fabric. Requests are made of the weaver to make changes. When the changed fabric, possibly after many modifications have been made, works, a new fabric is born. On occasion it is later discovered that the original trouble was due to something other than fabric design. By this time, however, a new fabric construction is on the market.

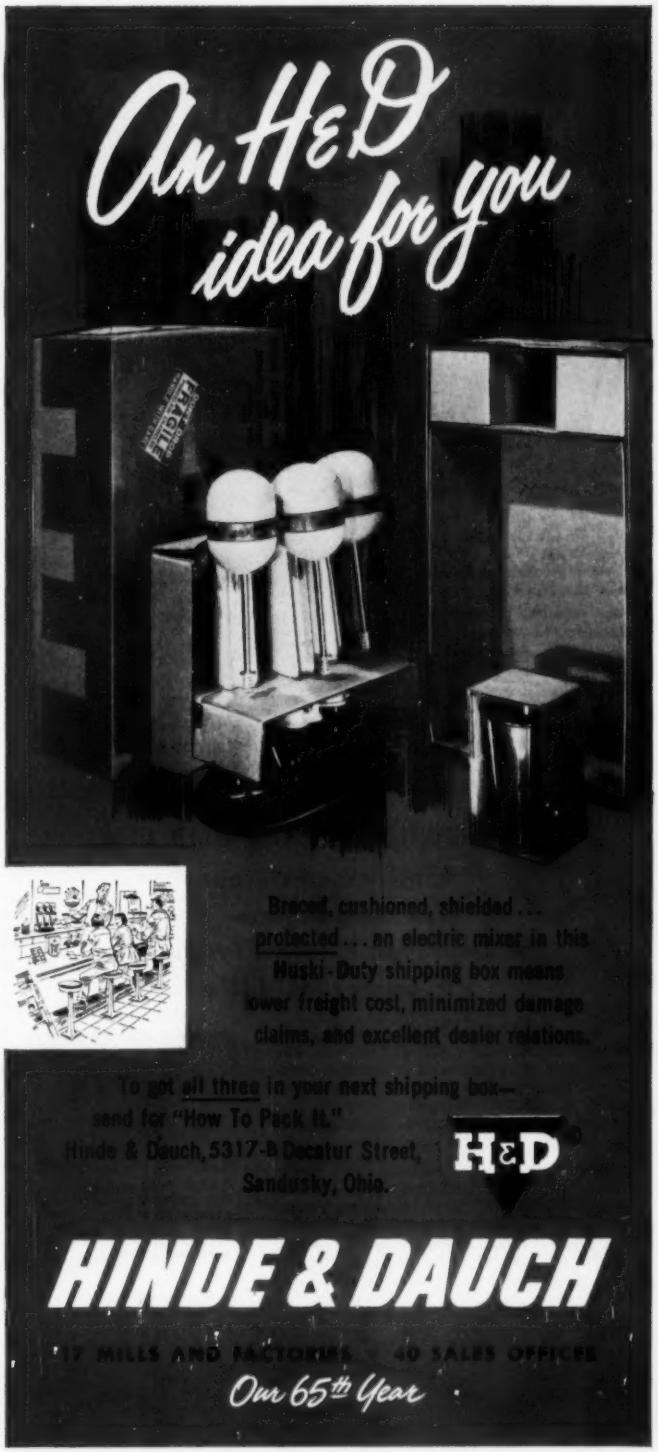
6) The apparent result of all this is that there seems to be an infinite number of fabric constructions.

This confusing situation is not likely to be clarified nor simplified in the near future. Old timers who lived through the growth period discussed above actually have very little trouble.

Features to Look For

Those less familiar with glass fabrics can look for features in a glass fabric other than the inherent properties of the glass fibers. These include: index of thickness, index of porosity, index of weight, index of strength in warp or filling, index of flexibility, type of weave, proper finish for end use. Any competent supplier can furnish complete information on the above. The process of making glass yarn and of weaving it into fabrics is well established. It is in the hands of competent and conscientious people.

Table 3 shows in general the strength characteristics available in reinforced plastics. These data were obtained from laboratory specimens and, therefore, can be used only as a guide to physical properties ob-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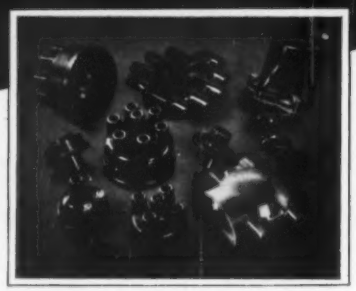

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tainable under optimum conditions. Properties of many products produced from glass reinforced plastics vary considerably from the above data. Generally, as the glass-to-resin ratio increases, the strength increases proportionately. The glass content of laminates is limited by the fabrication technique, by the characteristics of the resin, and by the form in which the glass is supplied.

The reason that glass fabrics are used to reinforce plastics in preference to other forms of glass in many applications is that they impart consistent and predictable strengths to laminates. Some glass fabrics are somewhat higher in cost than other forms of glass fibers. This is often offset by the ease with which they can be handled; by the fact that less resin is needed than when bulkier forms of glass are used; and by designing products so that the high strength obtainable from fabric is fully utilized.

The weavers realize that if a woven reinforcing material that would have the ultimate in properties at a low cost could be made available to fabricators, problems concerning nomenclature could be practically eliminated and present markets would be substantially increased. Considerable work is being done to achieve this but such projects are still in development stages. Available facilities and existing know-how for weaving glass are adequate for all glass yarn now being produced—with plenty of room for any foreseeable expansion.

To the uninitiated in the reinforced plastics business the selection of the proper glass fabric for reinforcement will be less complicated if he will take his supplier into his confidence and tell him exactly what he is trying to accomplish. It is to the supplier's advantage to offer the lowest-cost material that will do the job economically for the fabricator.

The editors wish to thank the following companies for their kind cooperation in the development of basic information for this project: Hess, Goldsmith & Co., Inc.; Deering Milliken & Co., Inc.; United Merchants Industrial Fabrics Corp.; J. P. Stevens & Co., Inc.; J. P. Schwebel Company; Textiglass Div., Madagascar Graphite & Mica Co.; Soule Mill; Coast Manufacturing & Supply Co.

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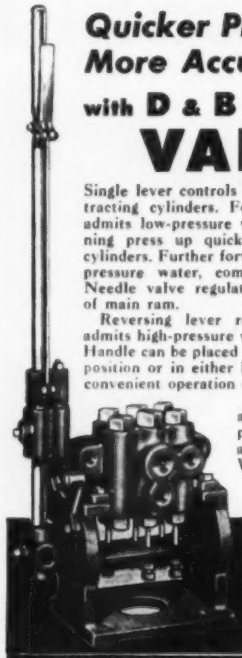

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Film and Sheet

(*Continued from* p. 99)

forms of textiles. There has been a vast improvement in design, finish, and construction of all vinyls since their introduction a few years ago and it is disheartening to hear such severe criticism. Where are the suggestions on *how* to improve by taking advantage of this material's individual properties? Less talk and more practical suggestions on how to reach this goal of "individual design for vinyl" by the very people who complain about it would probably be welcomed.

The complaints about quality are perhaps more justified. At least most people in the industry admit that there is more low quality film on the market than they like. This situation has unfortunately developed from scarcities at various times and also from a highly competitive price structure in the film market. Scarcities led to use of inferior materials; price cutting inevitably leads to lower quality.

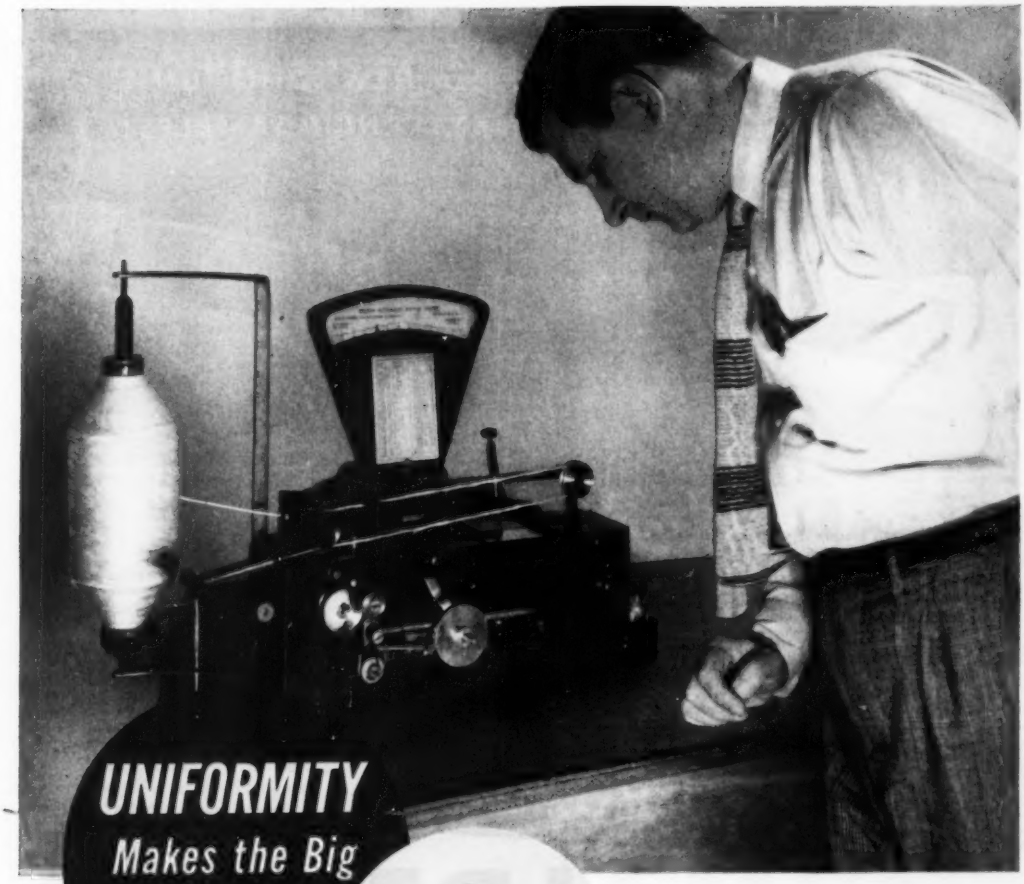
A set of standards that will permit use of a hallmark only to those who can meet certain specifications is urged by many as the only answer to the quality problem. The Society of the Plastics Industry Committee on Film and Sheeting has worked hard and earnestly on this problem. There have been 70 meetings since 1946 by 188 men from the industry who have 11 different committees working on various aspects of a Commercial Standard that would include minimum requirements for such things as low temperature flexibility; tear strength; aging; crocking; blocking; mildew resistance; and other properties. In addition, they have conducted scores of round robin tests and worked with ASTM to establish satisfactory testing methods.

Six Years of Work

After six years of work, a tentative Commercial Standard was drawn up and in August 1952 copies were sent to a limited list including other trade associations, testing laboratories, customers, producers, etc., for criticism. Written comment from the recipients of the proposed Standards was then assembled by the Bureau of Standards. At a meeting in Washington on Nov. 18, the proposed Standards were revised and approved to meet the recommendations and suggestions that had been received up to that time. The revised Standards are now being mimeographed by the Dept. of Commerce prior to final circulation to all producers, users, and customers of vinyl film. If they are accepted by 65% (dollar volume) of the industry, they will be promulgated, and those who live up to the Standards will receive a hallmark which guarantees that their goods meet certain specifications.

Six years seem a long time to wait for action, but the problems of setting standards for this industry are almost too complex for belief.

A brief example of the troubles encountered is exhibited by those of Group II on tear resistance. The group held 12 meetings between Dec. 1946 and May 1952 in addition to some 10 round robin tests by members. After two years and five meetings, they devised a new test as the best of five under consideration. It was thought that this new Graves type test would meet all requirements. But many in the indus-



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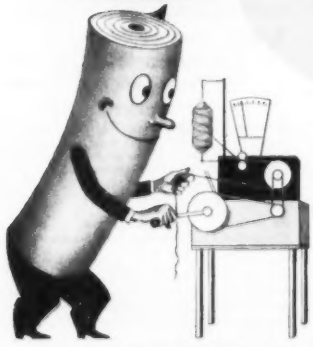

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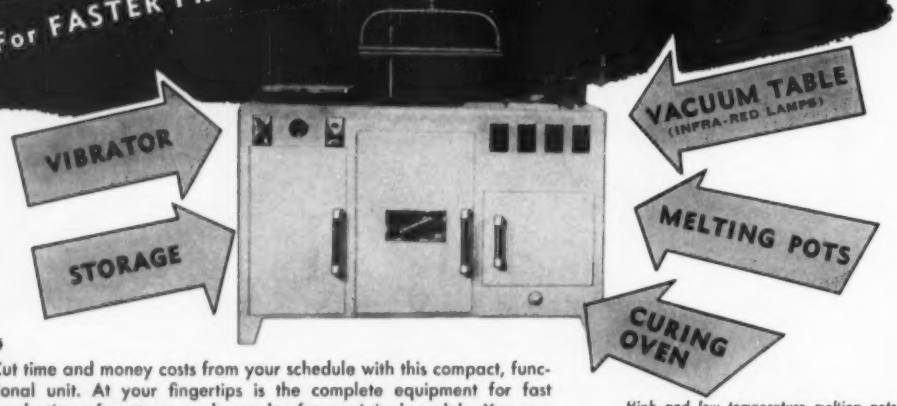

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try would not give up the old Elmendorf test. They thought it served their purpose better because it was more reproducible from one laboratory to another. It gives a fast tear rather than a slow pull and was claimed to be a better control method. The end result, after much debate, was that both tests are now in the Standards; that is, either one can be used. Elmendorf advocates say that if their material will take an Elmendorf, it will take a Graves —so they won't worry. Defenders of this dual specification claim that, in any case, inferior material will fail to pass either test.

Tough Going

All 11 groups had similar experiences in coming to agreement. It has been tough going and few people are satisfied—many claim that the Standards have not been set high enough. The Sheet and Coated Fabric people claim they will have no truck with such a set of standards for fear they will encourage minimum instead of maximum standards. There are no abrasion, migration, nor accelerating tests in the Standards, for it is claimed they cannot be made reproducible from plant to plant. There are no tests for embossed film in the Standards and nearly all film made today is embossed.

Nevertheless, S.P.I. committee members are convinced that the present Standards are a step forward in the promotion of a healthy vinyl film industry—the only step that will do any good in preventing chaos in film merchandising. In answer to those who claim that the Standards are weak, the defenders say that probably 20 to 30% of presently produced plain film would be unable to meet them and thus unable to obtain a hallmark. The proposed Standards won't guarantee the disappearance of poor film nor correct all shortcomings, say S.P.I. committee members, but at least a start will have been made in establishing a base from which to proceed.

Finishing Methods

The matter of improvement in quality of methods for finishing film and sheeting was left largely to an equipment manufacturer who gave the many attentive listeners in his audience some interesting evi-

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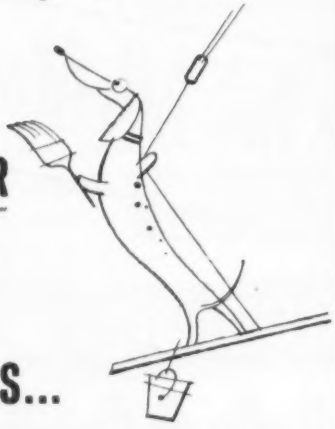

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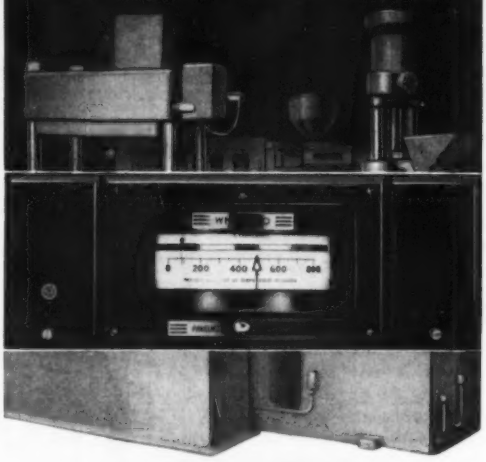

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dence of trends now showing up in the industry. Among other things he mentioned:

Only 24% of those questioned in a survey were interested in perforations or cut-out decorations of vinyl film.

Thirty-five percent were interested in flocked film and sheeting. The applications were table coverings and luggage coverings where adhesives are required.

Silvering or metallizing is not yet satisfactory. Volatility of plasticizers in the vacuum chambers has been a principal problem.

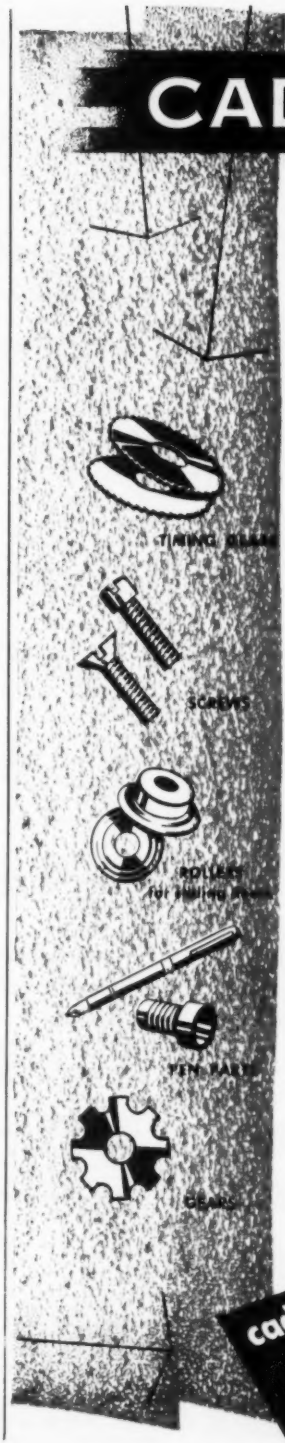
Electronic quilting or heat sealing a padde filling between two film sheets has been well received. A recent variation has been the use of specially treated non-woven webs to which the face sheet can be electronically welded.

In the conversion processes of printing and embossing, the standardized quality film and sheeting is often stretched and distorted so that the finished product that reaches the market exhibits properties of poor dimensional stability and unbalanced tensile and tearing strength. The reduced gage of such a stretched embossed product would be difficult to check. To illustrate the acceptance of these abuses, there have been advertisements for converting equipment which promise as much as 25% increase in yardage.

Another aspect of the embossing problem relates to the temperature of embossing. As is well known in the trade, the temperature at which a sheet has been embossed can be determined by slowly heating the embossed sample and noting the temperature of grain release. Patterns that are set into a vinyl film by sufficient embossing pressure, but at a temperature below the true softening and flow point of the film, are unsatisfactory in permanence and they also adversely affect the dimensional stability and strength of the film.

Today's top quality converters have overcome these difficulties by redesign of converting equipment; the finished product is quite satisfactory. There should be, however, some standard of quality that could be indicated by a label so that the purchaser of the material would be protected.

Based on the opinions of a great



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number of film and sheeting producers, converters, and consumers, the following trends are anticipated:

Trends

a) Increase in popularity of the ink embossing technique and possible introduction of multi-color ink embossing in register. Machinery for this process has already been designed and is in operation in the paper industry. Ninety-four percent of responses to industry questionnaire were favorable to this development.

b) Substantial increase in the volume of products manufactured by the embossing-lamination technique. This increase includes vinyl webs as well as vinyl webs to non-woven webs. The vinyl-to-vinyl will generally be clear protective films applied over printed vinyl surfaces. The lamination to non-woven bases will be made to provide plumpness, strength, and better stitching and cementing properties using thinner vinyl sheets. The production of bonded fiber non-woven fabrics has grown during the past 10 years from an annual figure of a few thousand lb. to more than 24 million lb. today. This production rate is expected to be doubled each three years during the next decade. Such products will undoubtedly find wide use as reinforcements and supports for vinyl film and sheeting.

Conversion

Conversion is becoming more and more a custom finishing job and less and less a volume operation. The range of pattern that can be embossed to permit subsequent printing of light-weight films is limited to fairly flat contours. Ninety percent of responses to the industry questionnaire indicated that a "substantial" volume of production would be embossed after the printing operation. The problem of changing embossing patterns, in tandem with calenders and without loss of production, will increase as the pattern variety increases and as the complexity of the finishing operation develops.

The days of long production of the same embossing pattern directly on calendered film will decrease as the smaller converters learn to produce attractive effects and to service customers with quick delivery of smaller quantities of finished goods.

The consumer should not be required to maintain high inventories of finished stock, but rather should depend on the converter who can produce on short notice from intermediate plain stocks as needed.

The real sales advantage and the better profit margin will go to the producers and converters who offer new finishes and new constructions. Nearly all producers of plastic film and sheeting use resins and plasticizers at stabilized purchase prices. The relatively small percentage of cost represented by preparation of raw materials and by selling expense should be substantially the same for all efficient producers. The only margin of difference from a cost standpoint is in the rate of film production; i.e., the direct labor and overhead, and even here the amortization of costly high production equipment partially off-sets this advantage.

The trend obviously is toward more efficient equipment but with flexibility enough so that a producer may turn out fairly small orders of multiple designs at mass production speed.

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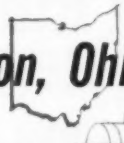
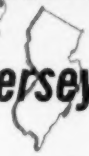

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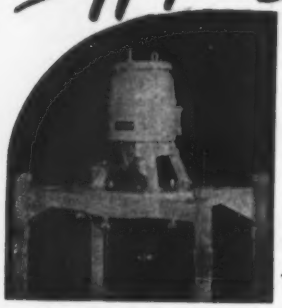

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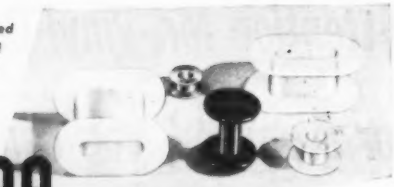

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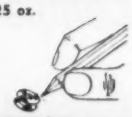

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Quenched Film

(*Continued from p. 120*)

soluble in many common organic liquids. A still further effect of plasticization is impairment of heat aging properties by lowering of the viscosity of the amorphous phase, thereby permitting greater freedom for crystallite and spherulite growth. It is felt that some of the difficulties encountered may have been the result of slow cooling during extrusion and that more extensive improvement in low temperature properties can be obtained by flat film extrusion and quenching.

Brittleness

Evaluation of the low temperature brittleness properties of plastics films is troublesome since there do not appear to be any standard tests which are entirely suitable. Falling ball or other impact type tests usually assume a go—no-go nature which is difficult to relate to practical usage, while bending or flexing tests generally necessitate a statistical approach. Some basic information can be obtained from a study of low temperature stress-strain diagrams, however, and a brief investigation of several types of fluorothene film has been made using a Baldwin-Southwark universal testing machine at a speed of 0.1 to 0.5 in. per minute. Elongation at break data versus temperature are shown in Fig. 4. Superiority of quenched, compared to tubular extruded, film is clearly indicated at all temperatures. The apparent advantage of plasticization in the room temperature region is again seen to disappear, as in the stiffness data of Fig. 3, at about —50° C.

A more complete study of the mechanical, chemical, and electrical properties of quenched fluorothene film is in progress, but a detailed listing of these properties is not yet available. Some additional data are given in Table II.

The nomograph of Fig. 5 has been found very helpful in estimating film weights and extrusion speeds for fluorothene films of given thickness and width.

The assistance of W. M. Land in the preparation of extruded films and R. H. Carey for studies of low temperature mechanical properties is gratefully acknowledged.—END

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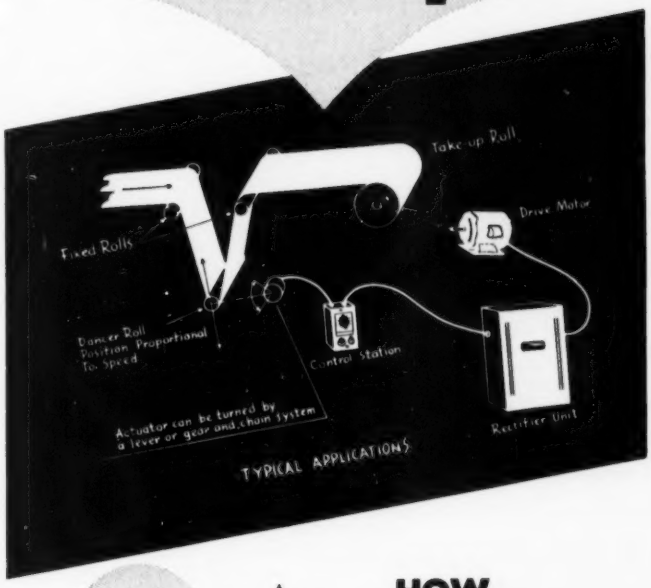

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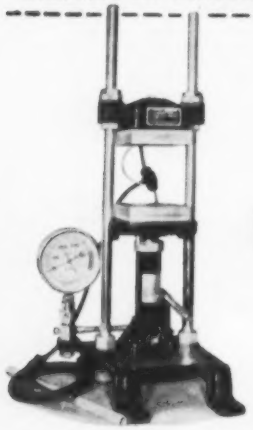

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S. P. E. Conference

(*Continued from p. 126*)

Finally, the paper briefly discussed the most recent developments in this specialized field of plating on plastics such as the employment of "gas-plating" and the manufacture of conductive plastics.

Mold Design and Standardization

Rene P. Magnenat, Waterbury Companies, Inc.

Emphasis in this paper was on the particular parts of mold making which are usually taken for granted.

The "minor details" were divided into three main groups—1) alignment of mold halves; 2) ejection; 3) supporting and resisting pressure—and the discussion dealt with each group in detail.

Engineering Design for Rubber Phenolics

A. P. Landall, General Electric Co.

The background of the rubber-phenolic compounds, along with their standard physical characteristics, were discussed briefly. Mold design data were stressed, including types of molds for various applications with special attention to shrinkage, dimensional tolerance, warpage, and surface finish. The speaker, by the aid of slides, illustrated the various points brought out in the talk by showing actual applications of rubber-phenolic molding materials, together with the design data which made them successful.

Plastic Problems in Electrical Motors and Generators

Otto Wulfert, Wagner Electric Corp.

In agreement with the theme of the conference, this paper dealt with designs which have been changed from metal to plastics construction and discussed the requirements of such changes. The thought of "Plastics—Engineered for Tomorrow" fits particularly well into the electric motor industry where it is difficult—because of established designs, established practices, customer acceptance, or just plain opposition—to make any change. It is the usual practice of the electric motor industry to make no changes unless the present design is unsatisfactory, even though it is almost apparent that materials such as plastics would answer the purpose and cost less.

There is at present, however, an extended use of plastics in electric motors which is far greater than is realized by the ordinary individual.

Tomorrow's Roll Surface Temperature Control and New Press Heating Systems

Paul L. Geiringer, American Hydrotherm Corp.

The use of high temperature water for heating calenders and presses is increasing due to the current demand of the plastics industry for uninterrupted production of plastics films and coated fabrics of greater uniformity at increasingly faster roll speeds. High temperature water permits maintenance of uniform surface temperatures, ease of temperature control, and ready adaptation of heating cycles when operating calenders at high roll speeds.

Cracked rolls and loss of production time and material result from attempting to cool steam-heated rolls

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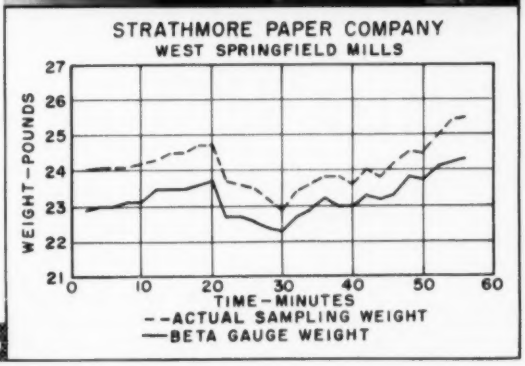
This outstanding New England firm is always striving to improve quality for their customers, and the gauge was purchased primarily for this purpose. In addition to maintaining greater weight uniformity, however, Strathmore has found that the gauge has effected savings in raw materials. Other mills operating Tracerlab gauges have found that raw material savings quickly repay the gauge's low cost.

Upper picture shows Strathmore Beta Gauge installation; lower chart graphically presents an unexplained machine aberration noted by the gauge and recorder and confirmed by subsequent sample weighings. Minor discrepancies between curves are due to the difficulty of getting samples in exactly corresponding places.



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with water. The cost of conversion to high temperature water is coming down while the cost of using steam is increasing. It is not advisable to attempt the application of high temperature water without the advice of engineering organizations experienced in this field.

A new surface temperature control method makes use of an indirect indication of the roll or platen surface temperature. This control device is motivated directly by the heat flow to or from the roll rather than by the surface temperature, thus providing superior control in the heating, cooling, and especially the transition phases of calender and press cycles.

New packaged units are now available for calender conversions to high temperature water. These units are inexpensive and more compact than heretofore, incorporating the benefits of considerable experience in plastics applications.

The heat accumulation capacity of high temperature water is especially advantageous for press heating, reducing fluctuations in boiler load and in the time required for each cycle.

Thermoplastic Sheet Applications

Wesley S. Larson and Rolland C. Trudeau, DeBell & Richardson, Inc.

A short review was made of the types, shapes, and applications of thermoplastics which are conventionally formed and welded. Some case histories and slides were shown and the methods of forming and welding were demonstrated.

The applications of new thermoplastics and unusual uses of fabricated shapes were also covered, and the possibilities and economics of this type of production were discussed. Technical details of the welding operation were presented.

Operating Characteristics of Extruders

James F. Carley, Du Pont.

Operating characteristics for screws and dies of extruders were defined and the connection between them explained. Several different screws were described with emphasis on the sort of characteristics they can be expected to have. Data giving the actual characteristics during extrusion of Alathon and Lucite resins were presented and interpreted. Some conclusions were drawn regarding the types of screws needed to do different kinds of extrusion jobs.

The Design of a Screw for Plastics Extrusion

J. M. McKelvey, Du Pont.

The actual calculations of the dimensions of a screw for a specific plastics extrusion job were outlined. The basis of the calculations was discussed and the approximations involved were described. Performance data were cited for several different designs of extruders.

Plastics Engineered for Relief Map Reproduction

John J. Gurtowski, U. S. Dept. of the Army.

The increased demand for plastics relief maps by the Armed Services and the probable eventual use of relief maps in our educational institutions and in other phases of civilian life emphasize the need for re-evaluation of the materials now employed in map production and the search for new and better plastics materials to overcome the problems resulting from increased production. The plastics industry will be asked to tighten the thickness tolerances and improve the printing surfaces of its plastics sheet. New and better plastics printing inks must be developed for high speed off-set printing. New thermoplastic sheet material must be developed to meet the demand for lower temperature flexibility. Very stable, low-shrinkage, temperature and flame resistant casting resins are needed for producing light-weight molds from plaster production models. Stable, light-weight fillers and binders are needed for producing temperature resistant, stable, porous production molds to decrease mold production time. Finally, a casting material is needed to replace the plate glass used in negative drafting.

Closed Mold Molding Techniques

Edward F. Borro, Sr., Durez Plastics and Chemicals, Inc.

The elements involved in the successful use of a closed mold molding include: 1) practical part design; 2) selection of the right material; 3) mold design; 4) size of gates and

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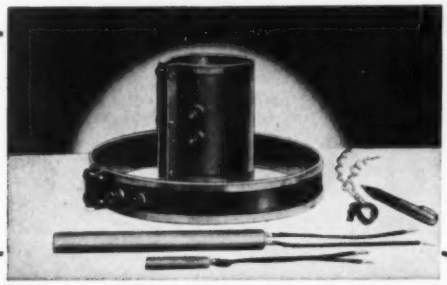

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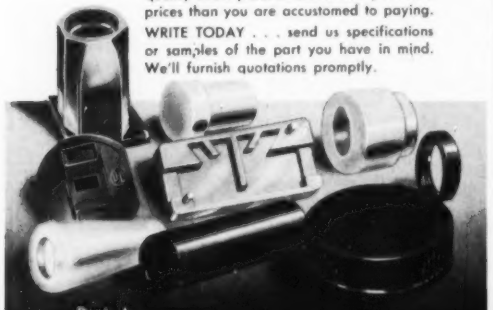

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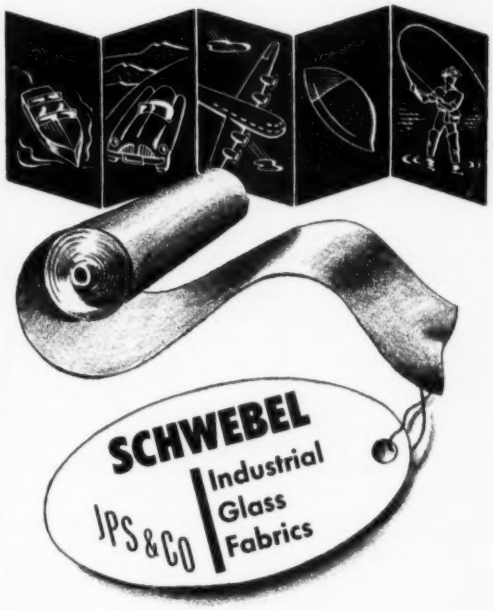

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runners; 5) position of gates; 6) transfer and clamping pressure. Pertinent data on dimensional stability and accuracy, mold wear, and the effects on physical and electrical properties in transfer or plunger molding were also discussed.

Equipment and Materials for Transfer Molding

Frank J. Donohue, Monsanto Chemical Co.

Transfer molding is carried out today principally in auxiliary ram presses. Some pot type transfer molding is still done, utilizing three-plate molds in straight compression presses.

Newer transfer or plunger molds are compactly arranged in racial layouts, where possible, and with short runners. Preheating, either dielectric or steam, is a "must" with this type of molding operation.

Phenolics in particular are, as a class, well suited to plunger molding. Special formulations, having rapid flow rates at moderate molding pressures, have been developed for this use. Melamine materials also show good transfer molding behavior, although some modification of the basic resin may be necessary to obtain best results. Ureas are generally not well suited to this operation, particularly in the production of large parts, because of their reactivity.

Plating Molds

Arthur W. Logozzo, Nutmeg Chrome Corp.

This talk brought the subject of plating thicknesses for various materials up-to-date. Topics discussed were hydrogen embrittlement through mold plating; what the mold maker should know about the plating operation; and advantages of plating molds. The session ended with a color movie on mold plating and polishing.

Use of Plastics in Business Machines

F. W. Reynolds, International Business Machines.

The uses to which plastics are put in these products demand extreme precision, a minimum of dimensional change due to temperature and humidity variations, and a maximum wear life. IBM is now using at least 17 different plastics which are fulfilling these requirements. There are four independent factors related to the satisfactory molded item: good part design; correct material choice; proper type of mold and mold design; and experienced molding technique.

Some Principles of Plastics Screw Extrusion

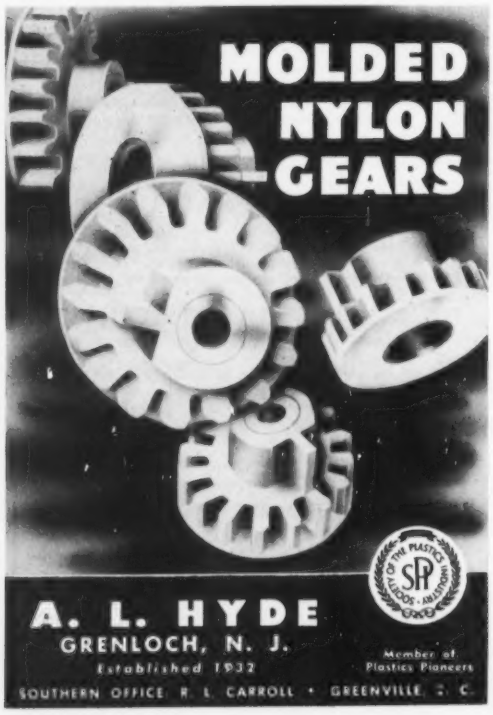
W. L. Gore, Du Pont.

The operational principles of a plastics extruder were described in general terms and the equation for calculating output, pressure, and power were given. The principles of scaling up from small to large extruders were discussed and the "cube" rule given for geometrically similar extruders. The nature of the operating characteristic curve for extruders was discussed.

Basic Factors in Plunger and Transfer Molding

Edward W. Vaill, Bakelite Co.

The discussion covered preheating techniques involving the use of radio frequency, infra-red, steam



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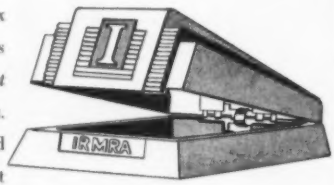

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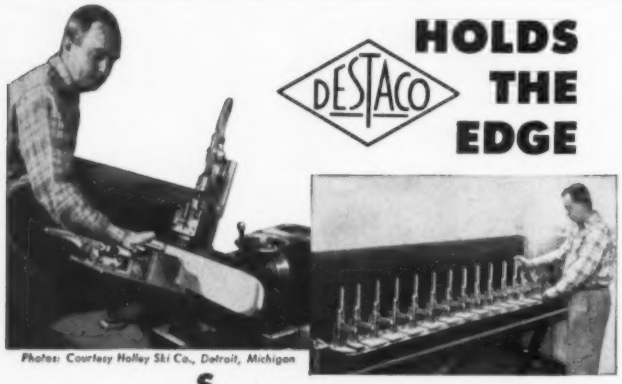

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Photos: Courtesy Holley Ski Co., Detroit, Michigan

Skiers know proper edging is most important for smooth slalom maneuvers. In production, precision tooling is necessary to obtain quality products. In the manufacturing of Plasti-Glass Skis the Holley Ski Company use De-Sta-Co's Model 620 Plunger Clamps to provide proper pressure during the slotting of the skis at a 22½ degree angle to allow for a patented moulded edge. Fifteen De-Sta-Co Model 110-C Toggle Clamps with Pressure-Matic adapters provide the necessary holding force to the welded angle plates which hold the ski in place during the cementing of the spring steel edges. Completely retractable the clamps allow easy insertion and removal of the skis from the drying fixture.

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oven, and dry oven methods. This included preform sizes, density, and positioning.

Plastics for Surgeons

Albert Lightbody, Engineering Dept., Naval Ordnance Laboratory.

The growing utilization of plastics for every conceivable use throughout the industry had made it inevitable that surgeons would become very active in this field. The use of plastics in the human body ranges from bones to arteries and from the head to the feet. Splints, casts, etc., are becoming common. The properties of plastics which make them of interest to the surgeon include coloring possibilities and non-irritating qualities. Corrosion resistance, stability in use, and flexibility give the body repairmen excellent material with which to work.

Other Papers

The following papers, for which abstracts were not available at press time, were also presented: "Large Mold Construction," by L. T. Raymond, Major Mold and Die Company; "Industrial Requirements for Plastics Engineers," by Robert C. Bartlett, National Varnished Products Corporation; "Present Status of Plastics Education in U.S.A.," by Charles C. Winding, Cornell University; "Better Plastics Engineers for the Industry," by Edward S. Bloom, E. I. du Pont de Nemours & Co., Inc.; "Future Training of Plastics Engineers," by Bryce Maxwell, Princeton University; "Epoxy Casting Materials," by Clinton Rector, National Engineering Products, Inc.; and "Polystyrene—25 Years of Progress," by A. J. Warner, Federal Telecommunication Laboratories.

S.P.E. Prize Papers

First prize: "The Basic Principles of the Injection Molding Process," by C. E. Beyer and R. B. Dahl, Midland, Michigan.

Second prize: "New Process for the Manufacture of Furfuryl Alcohol Resin Intermediates," by Erick R. Nielson, Chicago, Illinois.

Third prize: "Injection Molding of Elastomeric Vinyl Materials," by Frank A. Martin, No. Canton, Ohio.

Honorable mention: "Compounding and Processing of Rigid Polyvinyl Chloride," by Robert J. Ettinger, Avon Lake, Ohio.

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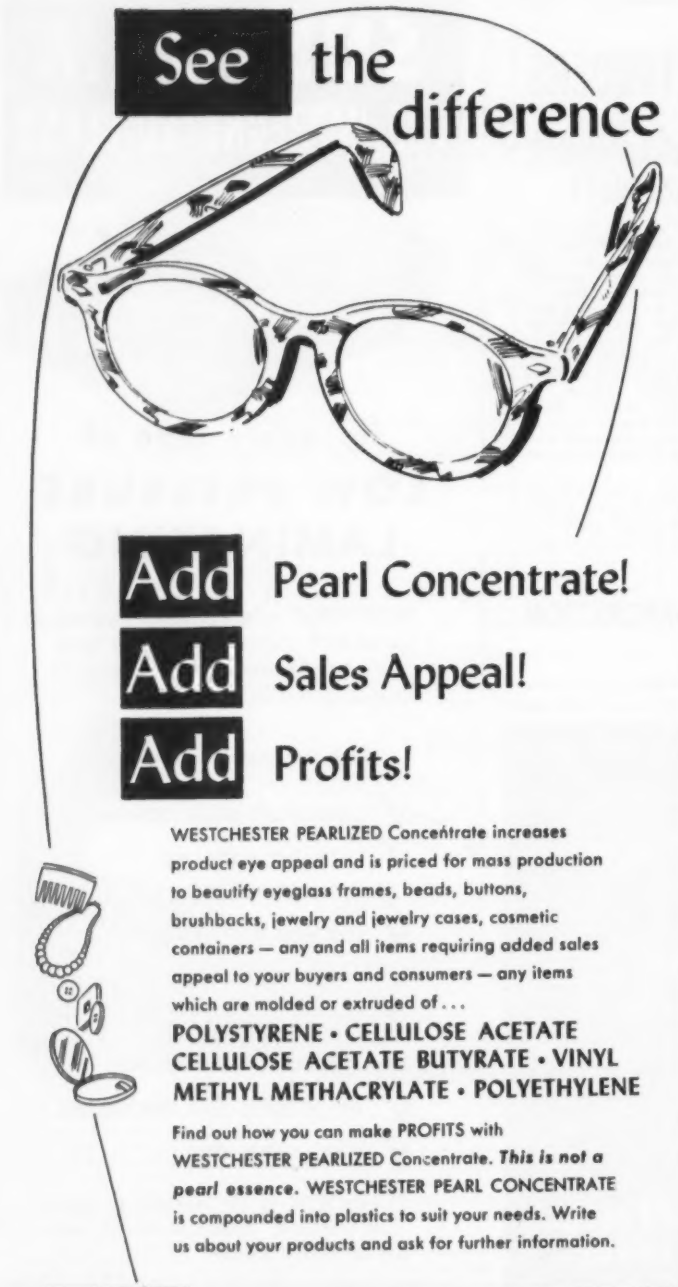
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Metallic Soaps

(*Continued from p. 134*)

tion during the fusion process.

This investigation was concerned only with the determination of relative gelling efficiency of various metallic soaps in plastigel compositions. In the final formulation other factors such as available processing equipment, method of application, and end-use of the product must be taken into consideration. In most cases the addition of fillers and pigments is desirable, in order to facilitate handling, impart strength, and decrease cost. The development of plastigels is so recent that it is hard to predict their future place in the plastics field. However, they have already proved to be well suited for caulking compounds, modeling clays, and in low pressure calendering and extrusion operations. Gelling agents have also found use in dipping and knife coating compositions, where careful viscosity control is necessary to produce the proper flow characteristics for the application of uniform coatings.

The technical advice and assistance given by Dr. E. T. Severs of Mellon Institute is gratefully acknowledged.

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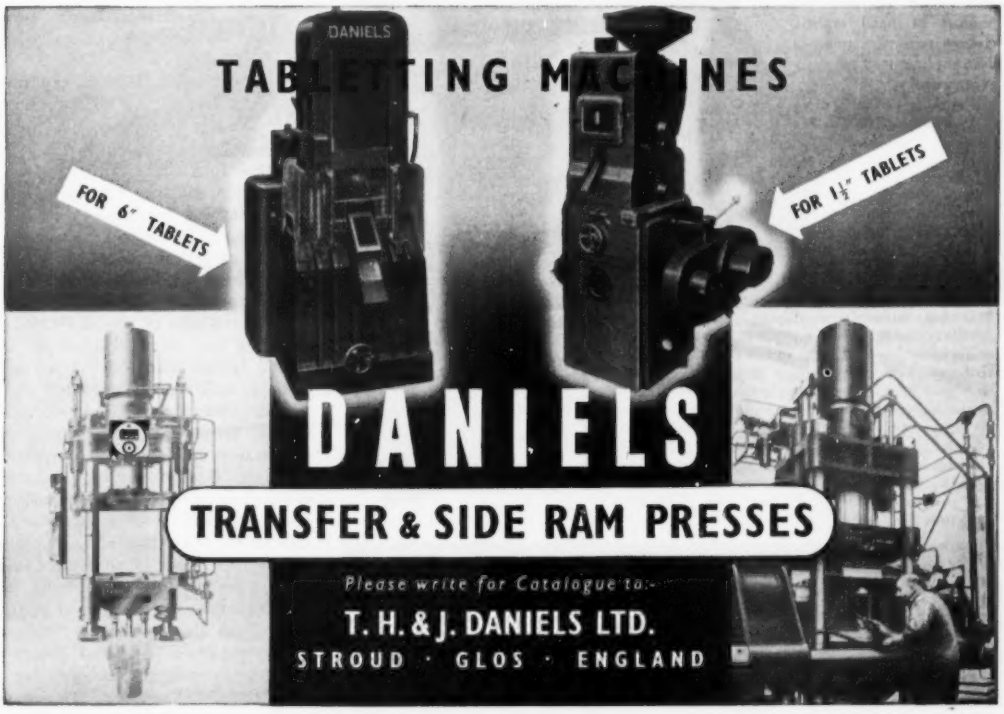

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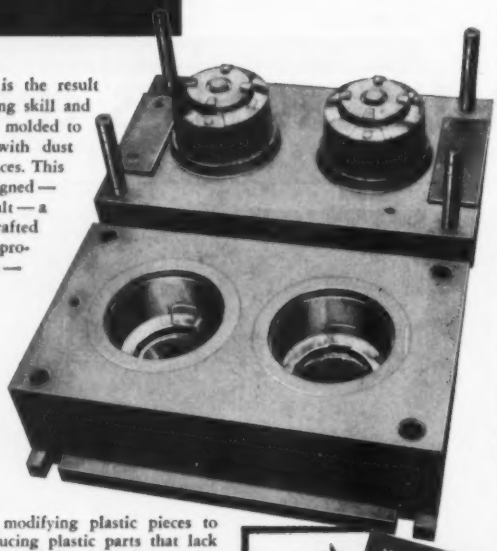
This motor housing is the result of Parker mold making skill and craftsmanship. It was molded to fit the components with dust tight, *air tight* tolerances. This mold was Parker designed — Parker built. The result — a product of hand crafted quality from efficient production line methods — every time!



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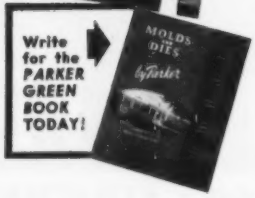

THE PARKER STAMP WORKS, INC.
PLASTIC MOLD DIVISION
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Structural Control

(*Continued from p. 138*)

the 2,2′ structure as a new variable in the control of resin cure speed. Its use in this capacity is illustrated in Fig. 2. The various sections of this chart represent the phenolic resins in relation to molecular weight and 2,2′ content. The resins for conventional general-purpose phenolic molding materials fall into section 8. Other commercial resins fall into sections 6 and 9. The C-22 fast-curing molding materials are based on the high 2,2′ resins in section 2. Sections 1, 3, 4, 5, and 7 represent areas of investigation and development directed toward increasing utility of phenolic resins, which now may be varied as to 2,2′ content and molecular weight. These are the main variables governing the performance of phenolic resins.

Control of molecular structure in the C-22 materials is obtained by the use of selective catalysts in resin production.[2] Acid catalysis, typical of the conventional "two-step" resins, promotes linkages in the ortho and para positions to produce a resin with a relatively low 2,2′ content of 20 percent. Selective catalysts, such as zinc, aluminum or magnesium force the linkage in the ortho position, producing a fast-curing resin of more than 50% 2,2′ content. Fig. 3 graphically describes the frequency of occurrence of the 2,2′ structure (circled) in an acid-catalyzed chain and in a zinc-catalyzed chain. Varying percentages of 2,2′ content are possible by careful control of reaction conditions, which include catalyst, temperature, pH, ratio of reactants, and reaction time.

The presence of the 2,2′ resin structure may be established by a special bromination test.[2] A second method, utilizing the infra-red absorption spectrum, is illustrated in Fig. 4. These data were obtained and interpreted by our Physical Chemical Group in their current study of the spectroscopy of phenolic resins. Analysis by infra-red absorption has proved valuable in verifying the various types of ring substitution. Furthermore, it provides a rapid check on the methods of preparation of the fast-curing resins. Fig. 4 compares infra-red absorption curves for an acid-catalyzed and a zinc-catalyzed resin. It is inter-

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Jacques, Jr. construction features add speed and efficiency to your cutting operations. Exclusive automatic material-holder (self-adjusting clamp) automatically comes down, as blade is lowered, to hold material to be cut. Adjustable gauge and steel rule (on table model) assure accurate cuts. Other features include high grade steel blades, spring tension cutting, and safety spring on blade handle (to prevent accidental cutting). Sturdy, all-metal construction stands up under continuous use.

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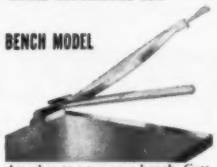

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esting to note that a resin extracted from a molding material will produce the same characteristic curve as the original pure resin.

The outstanding fast-cure feature of the C-22 molding materials permits increased molded part output and lower molding costs per unit produced. At present the commercial use of fast-cure materials requires slightly higher mold pressures to accommodate the decrease in flow due to increased cure speed. The molding press operation, itself, is faster, and more critical control of the pressure, temperature, and time factors must be maintained. Both plunger and compression molding are employed, with the former type being preferred for heavy sections. Electronic preheating is used extensively in C-22 applications. Users of the fast-cure resins have realized from 15 to 50% reduction in molding time. This is not due to the fast curing alone. Hot discharge of molded parts has been accelerated by the "hot rigidity" of these fast-cure molding materials which is superior to previous phenolic materials (Fig. 5). This combination of fast-cure and hot rigidity has been long sought after by the plastics industry.

Specific end products of C-22 molding materials include food-mixer handles, small radio cabinets, electrical control apparatus, wiring devices, iron handles, radio tube sockets, thermostat bases, terminal blocks, gear housings, and fuse box doors. In the case of food-mixer handles, molding time was reduced from 60 to 30 seconds. On larger moldings such as small radio cabinets, time savings from 15 to 25% were realized.

Although the fast-cure resins as they exist at this time apply primarily to molding materials of the C-22 type, further investigation points toward the use of the fast-cure effect in the preparation of materials for the laminating, adhesive, and coating fields. There has also been some indication that the 2,2[1] structure is of considerable importance in the production of even more rapid, one-step phenolic resins than are now commercially available. Laboratory development is continuing on these resins and it is felt that the principle of controlled 2.2[1] structure will serve as an important tool for increasing the range of usefulness of phenolic resins.—END

Evaluation

(*Continued from p. 146*)

in sprayed coatings. With the highly corrosive acid oxidizers this advantage is naturally of paramount importance.

For applications where bag liners are not convenient, such as propellant tanks in missile configurations, permanent installations in aircraft, storage, and transfer facilities, etc., the use of a plastic film bonded to metal may be required for selected propellants. Those films that show promise are bonded to steel plates by the recommended techniques including the application of heat and pressure and the use of suitable adhesives. Sheets of the laminated material are then fabricated into seamless test containers of about 1 pt. capacity by specialized deep drawing techniques. After checking the surface for pinholes the container is filled, closed, and left in storage. Periodic inspections of the condition of the container and the quality of the propellant are made.

Concluding Remarks

The foregoing discussion has been presented in order to bring to light some of the problems faced in evaluating plastics for liquid rocket propellant applications. Because of the fact that propellants employed are often new chemicals arising from recent research and development programs, information as to their behavior with various non-metal constructions is not always available. Standard physical and chemical test methods employed in appraising plastics today are not entirely adaptable to their rating for liquid propellant usage. Accordingly, improved methods are required to survey satisfactorily the field of plastics for liquid rocket propellant applications.

The foregoing test methods as developed are not completely satisfactory. More exhaustive and detailed efforts are required, particularly by the plastics industry where specific experience is available. The improvement of such tests, and the development of additional tests as considered necessary to properly evaluate plastics for liquid propellant applications will immeasurably assist in the development of liquid rocket engines.—END

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NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Ethyl Cellulose in Vinyl Film

SEVERAL vinyl film producers have been using ethyl cellulose flake as an additive to their vinyl chloride compound for producing film. About 1 to 3% ethyl cellulose is added. One of the principal qualities of the ethyl cellulose is that it helps to prevent shine on the film surface. It also helps roll release; acts as a lubricant; reduces tack; and is an anti-blocking agent. The ethyl cellulose flake is claimed to increase opalescence of clear film and reduce the gloss of pigmented film, thus making a product that more closely approaches the appearance and feel of fabric.

Phenolic Plant Damage Quickly Repaired

RESUMPTION of production of general purpose phenolic molding powder by mid-February is expected by officials of Bakelite Co., a Div. of Union Carbide & Carbon Corp., whose standard phenolic molding powder facilities were damaged by a fire at the Bound Brook, N. J., site late in December.

The fire in the phenolic standard molding materials plant, which followed a dust explosion in the upper part of the building, resulted in injury to 27 workers, five of whom have died. The origin of the explosion has not as yet been determined. It occurred in that part of the building where finely powdered molding material was being handled. The explosion blew out the roof and windows and damaged some, but not all, of the third floor mixing equipment. Little damage was done to the compounding equipment. The total cost in dollars for structural work and replacement is expected to be nearly a half million dollars.

The only company product affected by the accident is black and brown general purpose phenolic molding powder.

Although demand for general purpose phenolic molding powder has been running high since last September, it is not believed that this temporary curtailment in the Bakelite production line will have a serious effect on the supply situation. There was a 5 weeks' supply in inventory from which customers' demands can be met in most cases, although there will be a few cases where particular formulations cannot be had from the inventory stock.

Petroleum Resin

DEVELOPMENT of Piccopale, a low cost basic petroleum raw material, which is claimed to be completely different from any other petroleum resin, has been announced by Pennsylvania Industrial Chemical Corp., Clairton, Pa. It is a clear, clean, transparent thermoplastic produced by polymerization of unsaturates derived from deep cracking of petroleum.

The petroleum resin, which is 100% polymerized, is available in the following forms: Piccopale 100—flaked or solid with a melting point of 100° C; Piccopale 85—a solid with a melting point of 85° C; Piccopale 70—a solid with a melting point of 70° C; and Piccopale 100 Solution—60% solids in mineral spirits. The material is compatible with rubbers, polyethylene, coumarone-indene, phenolics, vinyls, and many other resins, waxes, and mineral oils. Piccopale 100 has a specific gravity at 25/25° C. of .970 to .975; it weighs 8.12 lb. per gallon.

Some of Piccopale's suggested uses are blending with polyethylene without causing serious loss in physical properties of the latter; with the softer grade coumarone-indenes to obtain greater light stability and aging; with high styrene butadiene copolymers as a softening and compounding aid; with ethyl cellulose strippable coatings; with vinyl resins as an extender and reinforcement for such items as tile, raincoats, shower curtains, pipe, coating for fibrous glass, and waterproofing compounds; and with styrene and styrene copolymers in limited amounts to improve the processing characteristics of these types of materials.

Old Timer Retires

ONE of the real pioneers in plastics, Charles F. Reeves, who began his career in the early Celluloid days, has retired as manager of Monsanto Chemical Co.'s Plastics Div. in New York. He will, however, become a consultant to work on special problems for the company.

Mr. Reeves will be succeeded by James P. Skehan, who joined Monsanto in 1929 as a laboratory assistant in the Plastics Div. headquarters at Springfield, Mass. Mr. Skehan became assistant manager of the Plastics Div. in New York in 1948 and also served in Washington, D. C., during 1950 and 1951, where he represented Monsanto's Plastics Div.

Rigid Sheet

ANNOUNCEMENT of availability of a complete range of thin rigid thermoplastic sheet materials for decorating, printing, and forming is made by Nixon Nitration Works, Nixon, N. J., one of the oldest companies in the thermoplastic sheet field.

With the exception of acrylic and straight polystyrene, Nixon now offers practically every variety of thin sheet for which there is substantial demand, including polyvinyl chloride acetate, hard polyvinyl chloride, cellulose acetate, cellulose nitrate, and cellulose acetate butyrate.

The materials are offered in standard colors and special made-to-order colors.

Designs for Vinyl

BETTER and different designs seem to be a constant need in order to increase vinyl film marketing possibilities, according to speakers at the industry's recent conference. However, it is not easy to develop and devise these new designs. Frank Baker, Landers Corp., 837 Buckingham St., Toledo, Ohio, tells how his company spent a year's time and thousands of dollars in an attempt to satisfy a potential cus-

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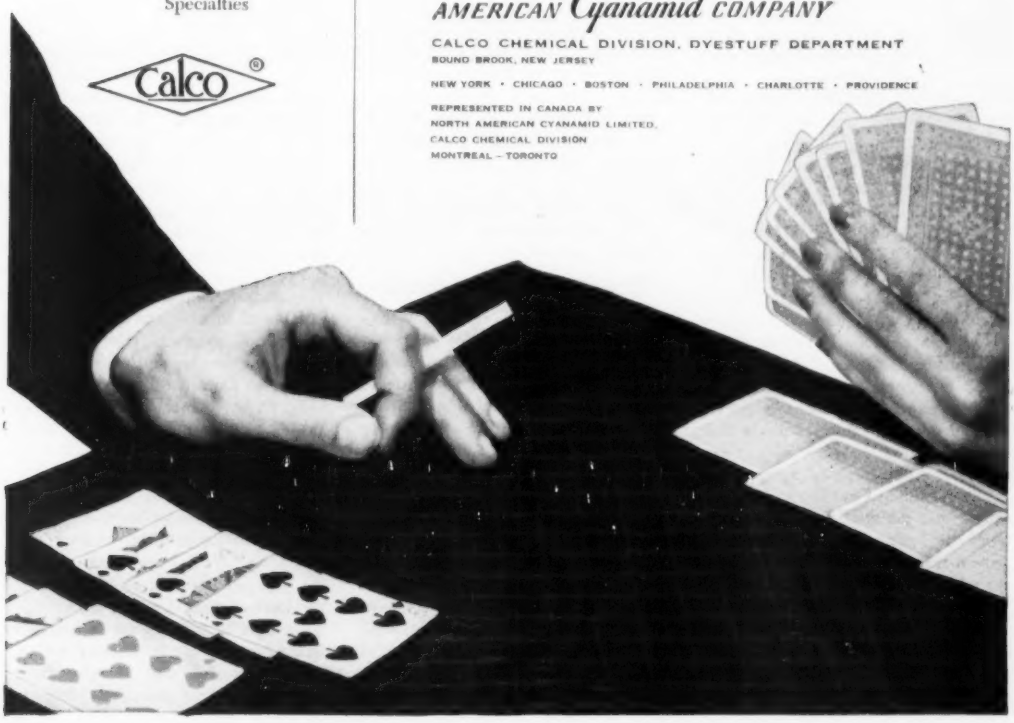

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tomer; after apparently getting him everything he wanted, the customer changed his mind and took nothing.

The customer wanted a vinyl sheet with a pattern showing an oak grain. The company sent to Australia for a particularly fine sample of Australian oak so that its grain could be reproduced in exact detail. Considerable expenditure was incurred to produce an engraving from which a satisfactory vinyl sheet could be produced to simulate the Australian oak grain. The company is now left with a fine engraving roll and a good pattern, but no customer.

According to Mr. Baker, this is by no means an unusual experience and is only one of the problems involved in trying to build up a big inventory of patterns from which customers will have a wide choice. It is at least a partial answer to the complaint of critics that the vinyl industry lacks ingenuity in the development of new ideas. Talk is cheap, but engraving rolls are expensive. Ideas are welcome, but somewhere along the line those ideas have to be translated into profits. All the talk about using the "different" properties of vinyl for new effects is meaningless until someone gives evidence of what he means by such talk.

Fibrous Glass Materials

FACILITIES for fabricating fibrous glass mats in weights from 2 to 10 oz. per sq. ft. and fibrous glass cloth in widths up to 150 in. have been set up at Thompsonville, Conn., by Bigelow-Sanford Carpet Co., Inc.

The new mats are claimed to be the first available in weights above 3 oz. per sq. ft. and eliminate the need for laminating lesser weight reinforcing mats. Lack of a contaminating mechanical or chemical binder adapts this material to use with all types of resins and provides improved translucence as well as good drapability.

The company contemplates the development of several additions to its fibrous glass products lines in the near future. Considerable interest has been shown in the company's wide loom fibrous glass cloth being produced in limited quantities. The range of processes and equipment available to Bigelow-Sanford makes possible a variety of woven constructions in widths up to as great as 150 inches.

Inquiries should be addressed to Russel F. Hurst, manager, Bigelow Glass Fiber Products, Bigelow-Sanford Carpet Co., 140 Madison Ave., New York 16, N. Y.

Metal-Like Plastics

A LOW COST substitute for pearl essence, called Nacromer, is now being used in lacquer to give plastics the appearance of metal. With the use of transparent pigments, any color is possible.

The material, also used in both extrusion and molding compounds, is produced by The Mearl Corp.'s Product Development Div., 153 Waverly Place, New York, N. Y.

Ducts

CORROSION-resistant ducts are now available in all-plastic, fully rigid construction from American Agile Corp., P. O. Box 168, Bedford, Ohio.

Fabricated from Agilene (polyethylene) or Agilide (unplasticized polyvinyl chloride), they are made to customer's specification—square or round design—and shipped to the site of final installation in easy-to-assemble sections.

More Resin for More People

IN LINE with its continuing expansion in the plastics industry, Reichhold Chemicals, Inc., 630 Fifth Ave., New York, N. Y., announces the appointment of Archie H. Dean as sales manager of its newly formed Specialty Products Div. and Donald G. Patterson as technical assistant on resins and plastics to Henry H. Reichhold, chairman of the board. Mr. Patterson will establish liaison between the company's many plants and laboratories with particular attention to RCI's new series of polyester resins (Laminite) for reinforced plastics and resins for textile application. He was in charge of plastics development at the research laboratories of American Cyanamid Co., Stamford, Conn., for the past 15 years. Both appointees will be located at the Fifth Ave. offices.

In an annual report, company officials announced that Reichhold's 1952 purchasing bill amounted to $40 million. Part of the company's 1953 budget will be devoted to conversion to polyesters and to continued development of basic chemicals, including phthalic and maleic anhydride, formaldehyde, phenol, glycerine, sodium sulfate, and sodium sulfite.

The company has under control an additional annual supply of 50 million lb. of formaldehyde, created by the installation of a new type of producing unit in Seattle, Wash., and through purchases of a substantial interest in Watson-Park Co., Ballardvale, Mass. These facilities are expected to fill about ⅓ of the company's formaldehyde requirements. Additional formaldehyde units are contemplated at projected sites in the South.

RCI's annual report also points out that a latex emulsion vehicle, called Wallpol, was introduced in 1952, thus launching the firm in the American vinyl field. Its English affiliates, Vinyl Products, Ltd. and Vinatex, Ltd., both of London, have made vinyl-type emulsions for nearly a decade. A prediction was made by Henry H. Reichhold that before many years the water-base type finishes may completely supplant traditional paint formulations.

The company also developed during the year a powdered phenolic resin, Foundrez 7500, and doubled the phenol-producing capacity of its Tuscaloosa, Ala., unit, which is now capable of turning out 60 million lb. of phenol annually. Several new 10,000-gal. resin kettles were installed at Detroit, Mich., and Elizabeth, N. J., plants to help produce the anticipated volume of shell molding phenolic material. Reichhold marketing experts expect annual consumption of shell molding phenolics will range between 75 and 300 million lb. by 1957.

Among other expansions during the year were increased capacity in the Detroit plant for urea formaldehyde and laminating resins, and in San Francisco for laminating resins. Reichhold also had a winterized outdoor kettle for cooking various

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STYRON gives additional Beauty and Utility to new SERVEL "ELECTRIC WONDERBAR," portable refrigerette

With the handsome new Electric Wonderbar, Servel has created a unique and happy combination of utility and styling. This remarkable portable refrigerette is right at home in the living room, nursery, or as a TV snack spot in the recreation room. It freezes its own ice cubes and is an ideal refreshment center for the family. Doctors and other business executives will find the Servel Electric Wonderbar a useful piece of office equipment, too.

In creating the Electric Wonderbar, Servel used Styron for many of the essential parts. Because Styron (Dow polystyrene) is a durable, odorless, easy-to-clean plastic with excellent insulating properties, it offered a threefold advantage of utility, beauty and sales appeal.

Perhaps plastics can improve your product too; why not work together with experts from Dow's Plastics Technical Service and an experienced molder to give your new product, or present ones, more buy-appeal at the point-of-sale? Write today.

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resins on trial at Elizabeth, N. J. for thorough testing during the rugged winter season.

Tag Program

VINYL upholstery is now going to market with a new type of labeling. Bolta Products Sales, Inc., Lawrence, Mass., in a move to help retailers move furniture more rapidly, has restyled the Boltaflex tag. Under the new program, the tags are made available to furniture manufacturers upon request only, with or without the manufacturer's imprint.

The new tag points out not only the advantages, but also the limitations of the material, and lists complete how-to-care-for information necessary for long service life. It discourages overselling of the upholstery as a miracle fabric and helps the consumer make her own decision.

According to Bolta officials, the informative tag is spreading the idea of self service to furniture stores and helps to educate the consumer about plastic materials, as well as the retail sales clerk who frequently makes exaggerated claims which are injurious to the industry.

Soil Conditioner Conference

APPROVAL of a petition for a trade practice conference of the chemical soil conditioner industry has been announced by the Federal Trade Commission. The original petition for the conference was filed with the FTC on Oct. 27, 1952 by Henry A. Dreer, Inc., Philadelphia, Pa.

All manufacturers and formulators of chemical soil conditioners will be invited by the FTC to participate in the trade practice conference to formulate rules governing the advertising and other trade practices of the new industry.

Organosol on Paper

HOW TO coat paper with organosols on a Dilts Machine Works "Contracoater" (a reverse roll coater) was demonstrated to attendants at a recent TAPPI meeting, which was held in Syracuse, N. Y. R. F. Vokes, assistant manager of Dilts, explained the process in the company's laboratory in Fulton, N. Y. The coating line included a constant tension unwind and wind apparatus, oven, and after cooling equipment.

Dilts is a division of the Black-Clawson Co., Middletown, Ohio.

Polyethylene Sheets

LARGE polyethylene sheets are now being molded for the trade by Resistoflex Corp., Belleville 9, N. J. The two types available are straight polyethylene or polyethylene fibrous glass reinforced laminates. The sheets are made in sizes 36 by 36 in. and from 1/16 to 1 in. thick.

Change in Nomenclature

SEVERAL changes have been made by Monsanto Chemical Co., Springfield, Mass., in the nomenclature of its various styrene molding compounds. Lustrex LH, Monsanto's medium impact styrene, will be known as Lustrex LHA. Heat-resistant Cerex 250 joins the Lustrex family as Lustrex LXC. The company also announces that a new improved high impact styrene, Lustrex LHN, will replace material formerly designated as Lustrex LT.

Compressed Vinyl

DEVELOPMENT of a new and patented compounded polyvinyl chloride, designated as CPC, has been announced by Calresin Corp., 333 N. Santa Anita, Arcadia, Calif. The company claims that because of outstanding shockproof qualities in Armed Service testing, the material is now being used for unusual packaging requirements. The material does not compress as much as air foam products, but compresses considerably more than many types of rubber now on the market. This feature results in cushioning or floating the article being packaged.

Among its other features, CPC can be formed or molded inexpensively in any shape to fit the article it is to protect; it can be molded with a covering of cloth or other material on either side; it can be bonded to any known surface; it is fungus proof, and will not support combustion.

Various grades in all colors are supplied and engineered specifically to the article to be protected.

Electrode Protection

DEVELOPMENT of a new type electrode protective device, whereby the machine cannot damage the electrodes in the event of arcing, was recently completed by Mayflower Research Development Co., 6014 Hudson Blvd., West New York, N. J. It is claimed that one of these protectors will save a fabricator considerable expense in that the unit will minimize loss of down time and change-over. This particular electrode is so wired into the circuit that it will shut off all power before any damage can occur.

The company expects to produce 100 units during the month of February alone, which will be sold and installed on various machines at a cost of $175 each.

Deodorant Catalyst

ANNOUNCEMENT of a deodorant catalyst, a liquid hydrocarbon that removes odor from plastics, especially vinyl, has been made by Phillips Scientific Laboratories, P. O. Box 152, Arlington, N. J. It is recommended that the deodorant be added to the plasticizer rather than to the total compound whenever possible.

Lower Cost is Challenge

THE challenge facing members of the chemical industry in 1953 will be to lower the costs of manufacturing and distribution, according to J. R. Hoover, president, B. F. Goodrich Co., Rose Bldg., Akron, Ohio, in his year-end statement. He stated that sales have been increasing, but earnings decreasing because of added costs of materials, labor, and distribution, and high corporate tax rates.

Some of the Goodrich developments announced as having taken place in 1952 were the production of a new easier processing polyvinyl chloride resin; a new series of acrylic polymers which are used for such applications as latex viscosity modification and textile sizes; and increased production of sodium polyacrylate, which, in addition to its other uses, is the basic ingredi-

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As a group, manufacturers of major appliances are generally more exacting in their requirements than other purchasers of custom molding. For this reason, Ideal Plastics is extremely proud to serve so many of them.

Television escutcheon molded for Majestic Radio & Television, Division of Wilcox-Gay Corp. Typical of the many component parts Ideal molds for use in major appliances. Shipped completely spray painted, ready for installation.

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Under one roof Ideal offers you the most extensive, most modern, most efficient custom injection molding facilities that exist. You'll find it profitable to join company with the many nationally known companies we serve. Additional information is obtainable from A. C. Manovill, Vice Pres. in Charge of Sales, Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone AXtel 7-7000. Mid-west Representative, Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136.

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ent of many soil conditioners. In addition to these developments, a $6 million plant at Calvert City, Ky., is under construction for the manufacture of vinyl chloride monomer, which will begin production early in 1953. Capacity for the manufacture of Beta-alinine, glacial acrylic acid, and a number of polyacrylates from Beta-propiolactone has been expanded at Avon Lake, Ohio.

Purging Compound

STUBBORN plastic deposits in injection machine cylinders and nozzles can now be cleaned out with a water-clear granular crystal material developed by Plastic Molders Supply Co., 915 W. Front St., Plainfield, N. J. The material is nonabrasive to machine parts, yet acts as a harmless sandpaper in performing its purging operation. It is purged through cylinders at 475 to 500° F. temperature; 10 to 20 lb. should be sufficient to clean the most obstinate contamination.

Known as PMS Purging Compound, it is packaged in 50-, 100-, and 200-lb. drums at 35¢ per pound.

Spiral Washers

SPIRAL back-up washers made of Teflon for use in conjunction with "O" ring seals are being produced by Resistoflex Corp., 39 Plansoen St., Belleville, N. J., under license of Douglas Aircraft Corp.

The washers are claimed to be superior to leather when used in hydraulic systems operating above 1500 p.s.i., particularly at temperatures in excess of 200° F.

Color Appeal

A NEW twist for promoting the sales appeal of color has been initiated by Pantasote Co., 444 Madison Ave., New York, N. Y. The company has labeled its various styles of upholstery material with names of states as a prefix to imaginative color designations that tie in with the history or background of the state.

For example, Pantasote's Texas brand comes in sandalwood beige, tusk ivory, lemon yellow, and mahogany brown; Vermont is represented by green; the Oklahoma design features canyon red, thunder gray, or saddle tan; the Arizona pattern is available in the aforementioned shades, as well as petunia red.

Company officials admit that a color by any other name might look just as good, but colorful names have been found to be great boons to sales promotion.

Largest Sign

ONE OF the world's largest plastic-faced signs, architecturally integrated with an attractive building, identifies the First National Bank of Temple, Texas. The plastic portion of the sign, 130 ft. high, uses Plexiglas acrylic plastic.

Each face of the sign is composed of corrugated Plexiglas panels 3/16 in. thick, approximately 4 ft. wide and 6 ft. high, with the 2½-in. corrugations running vertically. Letters, 4 ft. high, of the same acrylic plastic, contrast with the background, which is yellow, giving readability at long distances as well as a pleasing color combination by day or night.

The entire sign structure weighs 18 tons, yet no visible cables or other supporting members disturb its symmetry. The sign was designed, fabricated, and erected by McMath-Axilrod Corp., Dallas, Texas, in cooperation with Wyatt C. Hedrick & Assoc., Dallas architects.

COMPANY NOTES

Electro-Devices, Inc., 6 Godwin Ave., Paterson, N. J., has acquired the electronic motor speed control interests of **Servo-Tek Products Co.** and will expand the line of Servospeed control systems under the newly formed Servospeed Div. A complete line of industrial electronic motor speed control systems for semi-automatic and automatic speed change, such as those used in the plastics industry, is available from 1/50 up to 2 hp.

American Wheelabrator & Equipment Corp., Mishawaka, Ind., has moved its New York City district office to 53 Newark St. Bldg., Hoboken, N. J. The following sales engineers have been assigned to the district office: **David Logan, K. E. Blessing,** and **F. J. Pichard.**

Bachman Bros., Inc., 1400 E. Erie Ave., Philadelphia, Pa., has named **Fred G. Iredale, Jr.,** and **S. Robert McClay** as sales assistants to **A. H. Redles,** secretary and director of sales for the company.

The Cellucraft Mfg. Co. has moved to 37 W. 20th St., New York, N. Y.

Goodrich-Gulf Chemicals, Inc. has been formed by B. F. Goodrich Co. and Gulf Oil Corporation. The head office will be in Pittsburgh, Pa., and a plant site for the new company will be at Orange, Texas. Goodrich-Gulf Chemicals has been organized for the purpose of exploring projects in the petrochemical field.

Alsynite Co. of America, San Diego, Calif., and Portsmouth, Ohio, has named **Thomas C. Wright** district manager for the Missouri-Iowa area. He will direct sales operations in all of Missouri and Iowa, and sections of Kansas, Nebraska, S. Dakota, Minnesota, and Illinois.

Dewey & Almy Chemical Co., Cambridge 40, Mass., has elected **Hugh S. Ferguson** as president and chief executive officer to succeed **Bradley Dewey,** who has retired. Mr. Dewey, who has been president since the company was founded in 1919, was elected chairman of the Board of Directors. Mr. Ferguson has been with Dewey & Almy for 28 years and has been executive vice president since 1948.

Arthur D. Little, Inc., 30 Memorial Drive, Cambridge, Mass., has established an International Div. to meet the increasing demand for its services abroad. The new division is headed by **A. G. Haldane,** who was previously with the U. S. Dept. of Commerce.

Kaye-Tex Mfg. Corp., 110 E. 23rd St., New York, N. Y., announces the following appointments: **Vernon C. Pierce,** formerly general manager of the company, is now vice president in charge of all plant operations and **Arnold C. Nyblade** has been named plant manager.

Ferro Chemical Corp., Bedford, Ohio, announces the appointment of the following sales agents to handle its line of products: **Ramco,** 95 Mar-

Lustrex Colorant Blend, supplied in handy 50-lb. bags, is poured into clean drum for tumbling.

Weighed colorant is added to crystals.

Colorant and crystals sealed in drum and tumbled.

Any shade of styrene you want

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Dry coloring Lustrex Colorant Blend

There are times when you'd give almost anything to have the shade of styrene you want *on a few minutes' notice*. Dry coloring Lustrex Colorant Blend can give you this security . . . and lower costs, too.

Dry coloring means greater flexibility of operation . . . you have the colors you want, when you want them, and in the amount you need.

Flexibility of operation is a big reason so many molders are dry coloring their own Lustrex styrene today. More than this, though, dry coloring is money in the bank because conversion costs are so low that you actually save *several cents a pound* compared with the purchase of colored molding powder. Inventory can be reduced by as much as 75%, tying up less capital.

It will pay you to send for the latest information on dry coloring contained in Monsanto's new booklet, "Improving Color Uniformity in Dry Coloring Lustrex Styrene Plastic." For your copy, please write: MONSANTO CHEMICAL COMPANY, Plastics Division, Room 2626, Springfield 2, Mass. Lustrex: Reg. U. S. Pat. Off.

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ket St., Oakland, Calif., for the northern California territory and **C. L. Duncan Co.,** 840 E. 60th St., Los Angeles, Calif., for the southern California territory.

Frank W. Egan & Co., 115 Lincoln Blvd., Bound Brook, N. J., has appointed **W. H. Willert** to its technical staff. Mr. Willert will handle the development of plastics extruding and processing equipment.

Reed-Prentice Corp., Worcester, Mass., has named **Eric Brierley** as sales engineer, in its Cleveland office in the Penton Bldg. Mr. Brierley has been with the company since 1947 and for the past four years had been assistant to the sales manager in the company's main office.

Bacon Industries, Inc., 192 Pleasant St., Watertown, Mass., has been set up to handle the production and manufacture of silicone rubber O-rings, gaskets, and similar specialty products. These items were formerly manufactured by **Frederick S. Bacon Laboratories,** the parent company.

Logo, Inc., 13799 S. Avenue O, Chicago, Ill., recently formed by **Bee Chemical Co.,** will specialize in the manufacture and sale of coatings for application to plastics and other related materials. The new company will also handle the Logoquant finishes and thinners heretofore manufactured by Bee Chemical. Finishes are available in all colors for polystyrene, acrylics, butyrate, and acetates; Toy Gloss has been developed for application to polystyrene and acetate toys. All personnel of Bee Chemical, as well as divisional sales offices and sales engineers in Detroit, Westport, Conn., and Los Angeles, will be transferred to Logo, Inc. Bee Chemical will broaden its own scope to include research, development, and promotion.

Cutler-Hammer, Inc., 492 N. 12th St., Milwaukee, Wis., has named **F. J. Meyer** division manager of Heating Device Sales.

Williamson Adhesives, Inc. has moved into its new plant at Skokie, Ill. The building also houses the new Williamson Specialty Compounding Div. The plant includes a well equipped laboratory for adhesive research and production control, a fireproofed room for processing inflammable products, and storage space for raw materials.

Resistoflex Corp., Belleville 9, N. J., has named **Western Fibrous Glass Products Co.,** 3049 E. 12th St., Los Angeles, Calif., as its West Coast distributor. With offices and warehouses in Los Angeles, San Francisco, and Seattle, the company will handle Fluorflex rod, sheet, and tube which are processed from Teflon and Kel-F resins.

Dow Chemical Co. announces the appointment of Styro Sales Co., 106 E. 41st St., New York, N. Y., as a distributor for Styrofoam.

Nesco, Inc., 201 N. Michigan Ave., Chicago, Ill., has moved its Sales and Advertising Depts. to the company's headquarters at 947 W. St. Paul Ave., Milwaukee, Wis.

High Vacuum Equipment Corp., 349 Lincoln St., Hingham, Mass., was recently organized for the development, design, and manufacture of high vacuum equipment used in the fields of electronics, metallurgy, plastics, and metals.

Fishman Plastics Co., dealers and converters of plastics scrap and surplus, has moved to larger quarters comprising 65,000 sq. ft. of space. The plant, located at the northeast corner of Garfield & Normal Blvds., Chicago, Ill., maintains large stocks of all the popular thermoplastic materials.

Tri-State Plastic Molding Co., Henderson, Ky., announces that new equipment and additional space will increase the company's production 25 percent. Two new hydraulic presses of 8 oz. capacity for molding plastics have been acquired, and new production lines will be set up. The company merchandises its products under the names of Freez-R-Ware and Tri-State Ware.

Metalectrics, Inc., 677 Broadway, New York, N. Y., specializing in the manufacture of porcelain and phenolic wire connectors, has been acquired by four brothers—**Jerome, Marvin, Stanley,** and **Milton Rabinowitz.**

Monsanto Chemical Co. announces the formation of a new jointly owned French company in association with **Compagnies Reunies des Glaces & Verres Speciaux de la France.** The new firm, **La Societe Monsanto-Boussois, S. A.,** will produce plastics materials, including polystyrene molding compounds which will be manufactured under processes owned by Monsanto and developed by its Plastics Div. at Springfield, Mass. Engineering will start immediately and construction will follow at Wingles, near Lens, France, the site of an existing glass manufacturing plant owned by the French parent company. Operations will start before mid-1953.

Einson-Freeman Co., Inc., Star & Borden Ave., Long Island City, N. Y., has appointed **Edwin Ellner** as general manager of its Plastics Forming Div. Mr. Ellner formerly served in the capacity of chief engineer of American Merri-Lei Corp., Brooklyn, N. Y.

Auto-Vac Co., 2120 Post Rd., Fairfield, Conn., is a new company producing vacuum forming machines. The new machines include a wide range of sizes and new design features for rapid, economical production. A small pilot-plant machine sells for about $1500; a single-table operation machine is priced around $5000; and a two-table machine at $10,000. The company is also setting up a product development and testing department to further the growth of the vacuum forming process. Several machines have already been installed with deliveries running from four to eight weeks after receipt of order.

The company has been organized by **E. Bowman Stratton,** who helped develop the Army Map Service vacuum process for making contour maps from plastic sheet, and **R. L. Butzko,** formerly of Noma Electric Co.

Randall Duster Corp., producer and distributor of Randall Dusters, has moved to 43 Fremd Ave., Rye, N. Y. The dusters are used by the plastics industry wherever coatings using as little as 2 oz. per hour or in quantities up to several hundred lb. are required. They are generally

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used on sheeting to prevent blocking, sticking, or mark-off in the roll.

The company has appointed **Anderson & Co.**, 547 Aqueduct St., Akron, Ohio, as distributor in that state, and **John W. Bell**, 9308 La Docena Lane, Rivera, Calif., as West Coast representative.

Molders Service Co. is now located at 2112 S. La Brea Ave., Los Angeles 16, Calif.

Harwick Standard Chemical Co., 901 Broad St. Bank Bldg., Trenton, N. J., has added **Hatco Chemical Co.'s** plasticizers to its line. The Hatco line includes dicapryl phthalate, di-iso-octyl phthalate, didecyl phthalate, dibutyl phthalate, and sebacic acid plasticizers.

Campro Co., 1300 Fourth St., S. W., Canton, Ohio, manufacturer of plastics housewares and premium items, has appointed **The Moses Bros.**, 1149 Merchandise Mart, Chicago, Ill., as its representative for the Middle Western states.

Boonton Molding Co., Boonton, N. J., recently celebrated its 30th Anniversary at a dinner at the Knoll Club in Boonton. **George K. Scribner**, president of the company, and **Mrs. Scribner** were presented with "30 Year Service Pins" by Fred K. Davidson, senior vice president of the organization. Mr. Scribner in turn awarded "30 Year Service Pins" to company employees who had been with the company for three decades. Guest speakers were **Charles Kinnear**, **Gordon Brown**, **William T. Cruze**, and **Charles Romieux**.

Plastic Service Corp., of which the late Saul Optner was president, was erroneously reported as located at La Porte, Ind., in this column last month. The correct address is 318 E. 32nd St., New York, N. Y.

Sundberg-Ferar, industrial designers, have opened their new building at 1204 S. Woodward Ave., Royal Oak, Mich. The building provides about 4000 sq. ft. of floor space and includes a model shop with complete facilities for making prototype models which may be presented to clients instead of drawings or sketches. An advanced design section is devoted solely to the designing for three to five years in advance.

Process Mold Co., 11471 Kercheval St., Detroit, Mich., announces the appointment of **Harold L. Donnel** as district representative for sales and engineering. Mr. Donnel's headquarters will be at 4619 Lomita St., Los Angeles, Calif.

Michigan Plastic Pipe Co., Detroit, Mich., has started production of Tufflite rigid and flexible plastic pipe at its Melvindale plant.

EXPANSION PLANS

Molded Resin Fiber Co., 4401 Benefit Ave., Ashtabula, Ohio, has constructed an addition to its plant to house the company's expanding Preform Dept. Two new preform machines have been purchased and the three machines now in the main plant will be moved into the new building. The equipment consists of one preform machine capable of handling parts up to 40 sq. ft.; one for parts up to 18 sq. ft.; and three to handle parts up to 10 sq. feet. The new oven designed for this machinery will have special conveyors which will handle parts from all five preform machines.

Doughboy Industries, Inc., New Richmond, Wis., is planning the most extensive long-range expansion program in the history of its Plastics Div. The company claims to be the largest manufacturer of inflatable plastics toys and expects to show an increase of 50% or more during 1953. Highlighting Doughboy's expansion developments will be increased use of its laminated Forti-plyed plastic film, which is laminated vinyl film processed by a special Doughboy method. It is claimed that this process eliminates the danger of leaks due to the presence of foreign particles or tiny holes.

American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y., has expanded production facilities at its Azusa, Calif., plant to include Laminac resins. The company reports that polyester resins have grown to an industry with estimated sales of 14 million pounds for 1952. In addition to polyester, the Azusa plant produces hydrocyanic acid for fumigation; mineral dressings; flotation process reagents; paint resins; and drilling compounds for the petroleum industry.

W. S. Shamban & Co. has moved into its recently constructed building at 11617 W. Jefferson Blvd., Culver City, Calif. The new facilities will increase by 300% capacity the manufacture of molded and fabricated aircraft and industrial products made from Kel-F, Teflon, nylon, and polyethylene.

Monsanto Chemical Co.'s Texas Div. plant at Texas City has started production and regular shipments of vinyl chloride monomer in tank cars and in small and intermediate size pressure cylinders. The new monomer is being made from acetylene, hydrochloric acid, ethylene, and chlorine. Productive capacity of the Texas City plant will be large enough to allow marketing of ethylene dichloride, as well as vinyl chloride.

The on-stream production of vinyl chloride is the second step in the current three-way expansion of the Texas City plant. The first step was completed last July when shipments of styrene monomer were started from the expanded styrene monomer plant.

PERSONAL

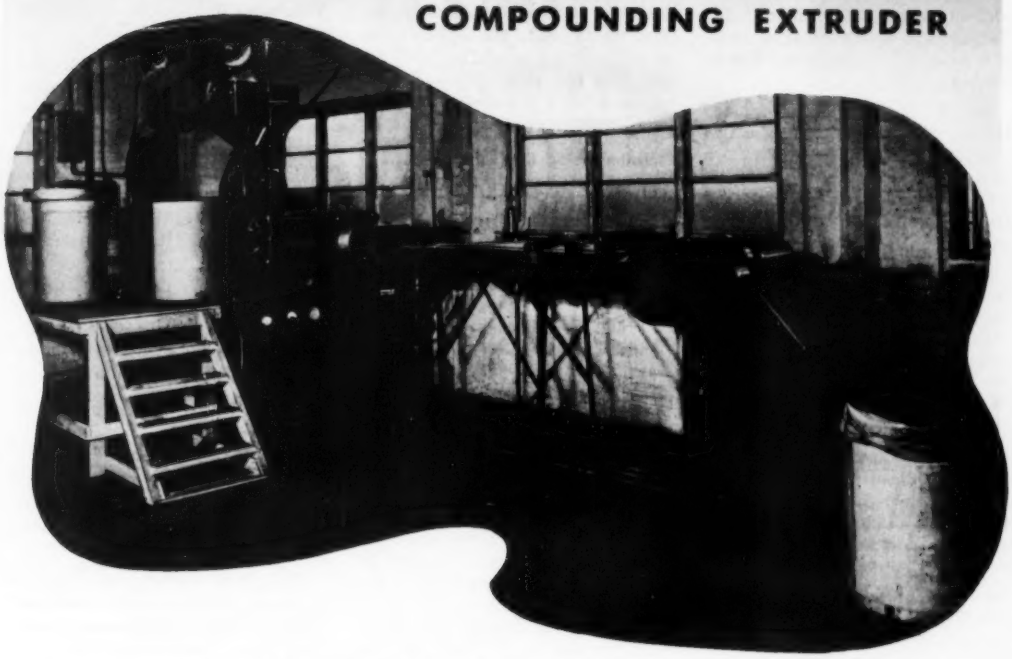
William W. Bell has been named sales manager of **Hatco Chemical Co.**, Kearny, N. J. He will handle the sales of the new odorless plasticizers recently introduced by Hatco.

William S. Richardson, vice president of **The B. F. Goodrich Co.**, Akron, Ohio, has been elected director of the company and also to the position of executive vice president.

W. C. Goodwine is now product manager of Plasticizers and Related Chemicals for the **Chemical Div., Celanese Corp. of America**, 180 Madison Ave., New York, N. Y.

Dr. Erik R. Nielsen has been awarded first place in a contest sponsored by the Chicago section of the Society of Plastics Engineers. His paper was titled: "A New Process for the Manufacture of Furfuryl

The Windsor R.C. 200 TRIPLE SCREW COMPOUNDING EXTRUDER



In order to produce their polystyrene into pellets ready for moulding, Messrs. O. & M. Kleemann, Ltd. of Welwyn Garden City, England, installed the equipment, shown above, in their works.

The machine supplied to compound this material into granular form is the "WINDSOR" R.C. 200 triple screw extruder.

"Our equipment, one of several on order, is pelletising styrene at an hourly output of 180-190 pounds per hour, running 7 days a week, 24 hours per day," states Mr. H. Kleemann, a director of O. & M. Kleemann, "giving perfect colour dispersion and uniform pellets ready for use."

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Alcohol Resin Intermediates." Dr. Nielsen is a senior chemist at Armour Research Foundation, Illinois Institute of Technology.

Dr. J. H. Bruun has joined **Hooker Electrochemical Co.**, 14 Union St., Niagara Falls, N. Y., as director of research. Dr. Bruun has been connected with **General Aniline & Film Corp.** for the past 10 years.

Ernest C. Bernhardt, formerly with **Monsanto Chemical Co.**, has received a Doctorate in Engineering from the Technische Hochschule, Darmstadt, Germany, and has joined **Du Pont's** Polychemicals Dept., Wilmington, Del.

P. E. Roggi, formerly of **Bakelite Corp.** and **Respro, Inc.**, has joined **Whitman Plastics Corp.**, 655 Summer St., Lynn, Mass., as technical director in charge of developmental and laboratory control work.

Richard L. Foote, formerly a member of the Plastics Section of the War Production Board and more recently sales manager of The Richardson Co., Melrose Park, Ill., is now sales manager of the Special Products Div., **Marathon Electric Mfg. Corp.**, Wausau, Wis. Marathon is primarily a producer of electric motors but is planning to expand its production of molded electrical parts.

Osgood V. Tracy has been elected president of **Enjay Co., Inc.**, a sales affiliate of **Esso Standard Oil Co.**, which markets petroleum chemicals. He will retain his position as general manager of the Chemical Products Dept. of Esso. Mr. Tracy recently returned to the company from a leave of absence as director of the Chemical Div. of the National Production Authority, Washington, D. C.

Charles W. Poole is now with **Ferro Chemical Corp.**, subsidiary of **Ferro Corp.**, Bedford, Ohio in charge of the Plastic Stabilizer Dept.

Martin I. Cowan, secretary and treasurer of **Consolidated Products Co., Inc.**, 15 Park Row, New York, N. Y., has announced his retirement from the company. He had been affiliated with Consolidated Products for 30 years. Mr. Cowan plans to continue his association with the chemical and allied processing industries as a consultant, advisor, and appraiser.

Ronald W. Post has been appointed director of engineering of **Boonton Molding Co.**, Boonton, N. J. Mr. Post has been associated with the company since 1931 as supervising engineer of all molded parts.

Frank R. Adams has been made field engineer in the Saginaw, Mich., territory by **The Bellows Co.**, Akron 9, Ohio, with headquarters at 702 Second National Bldg. Mr. Adams was formerly a distributor of cutting tools and mills supplies in this territory.

Herbert E. Hasenzahl has joined the **Pro-phy-lac-tic Brush Co.**, Florence, Mass., as chief engineer. He succeeds **John A. Peterson** who had retired. Mr. Hasenzahl comes to the company with 25 years of experience in the plastics field. He was first associated with Burroughs Co., which was then pioneering in the manufacture of hydraulic equipment and molds for the plastics industry. When Burroughs Co. was sold to Watson-Stillman, he acted in the capacity of consultant. Since then, he has been with Insul Co., Casco, and American Optical Co.

Rena Pasqualini has been made administrative assistant of the Sales Dept., **Plax Corp.**, Hartford 1, Conn.

Merle F. Schreurs has joined **B. F. Goodrich Chemical Co.'s** plastics materials group to head the practical fabric coating techniques and processes section. Mr. Schreurs was formerly with **Textileather Corp.**, Toledo, Ohio, and **Industrial Ovens, Inc.**, Cleveland, Ohio.

V. F. "Fritz" Wigal has joined **B. F. Goodrich Chemical Co.'s** plastic group as a technical service representative serving the calendering industry on film and sheeting applications. Mr. Wigal, who was group head in the laboratory of B. F. Goodrich's plant in Marietta, Ohio, has more than 12 years experience working in polyvinyl chloride plastics. He recently returned from Japan where he helped set up vinyl film and sheeting facilities for the **Yokohama Rubber Co.**, an associate of **Japanese Geon Co., Ltd.**

Robinson Ord has been appointed vice president of **Canadian Chemical & Cellulose Co., Ltd.**, 1242 Peel St., Montreal, Quebec, and vice president and general manager of **Canadian Chemical Co.**, P. O. Box 99, Edmonton, Alberta.

Canadian Chemical Co., affiliated with **Celanese Corp. of America,** 180 Madison Ave., New York, N. Y., is currently building a $63 million plant at Edmonton, Alberta, for the production of chemicals from liquefied petroleum gases and cellulose acetate and acetate textile yarn and fabrics.

MEETINGS

Feb. 1-4—Western Gift, Toy, and Housewares Show, Western Merchandise Mart and Civic Auditorium, San Francisco, Calif.

Feb. 18-20—Society of the Plastics Industry, Eighth Annual Reinforced Plastics Division Conference, Shoreham Hotel, Washington, D. C.

March 8-11—American Institute of Chemical Engineers, Buena Vista Hotel, Biloxi, Miss.

March 16-20—National Association of Corrosion Engineers, Ninth Annual Conference and Exhibition, Hotel Sherman, Chicago, Ill.

April 21—Association of Consulting Chemists & Chemical Engineers, Inc., Symposium, Hotel Belmont Plaza, New York, N. Y.

April 26-29—American Institute of Chemical Engineers, Royal York Hotel, Toronto, Ontario.

S. P. E. Meetings

Feb. 18—New York Section Technical Meeting, Gotham Hotel, New York, N. Y.

March 18—New York Section Technical Meeting, Gotham Hotel, New York, N. Y.

April 15—New York Section Technical Meeting, Gotham Hotel, New York, N. Y.

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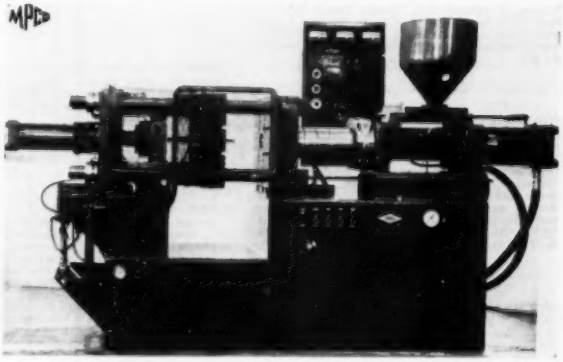
Marvel Filters are available in sump and line type models, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe fittings. For efficient filtration of liquids in all HYDRAULIC and LOW PRESSURE systems investigate Marvel Synclinal Filters.



IMPCO HA4-175 4 to 6 Oz. Plastic Molding Machine. Marvel Synclinal Filters protect the hydraulic systems in Impco's complete line of molding machinery, and are installed as standard equipment. Photo Courtesy Improved Paper Machinery Corporation Nashua, New Hampshire.

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FOR SALE: 1—Ball & Jewell No. 1½ Rotary Cutter, stainless steel. 4—Mikro Pulverizers #1-SH, #1-SI, #2-SI, #2-TH. 2—Kux Rotary Pellet Presses. 4—Stokes D-3 Rotary Pellet Presses. Read 600 lb. Jacketed Ribbon Mixer. Large stock Stainless Steel Tanks and Kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

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FOR SALE: 2 oz. injection machine "PLASTICOR." Manually operated. Can be used for production or laboratory. 110 V A.C. $750.00. Regular price over $1500.00. Reply Box 202, Modern Plastics.

FOR SALE: 200 ton Standard Molding Press. Stokes BB-3 Preforming Machine. Tumbling barrels, broaching machines. Reply Box 222, Modern Plastics.

FOR SALE: 35 Ton WS 18" x 18" Platen, 50 Ton PRESS 20" x 20" Pl., 75 Ton ADAMSON PRESS 20" x 20" Pl., 75 Ton WS 15" x 15" Pl., 140 Ton WS 23" x 17" Pl., 150 Ton HPM Triple Action 36" x 36" Pl. 175 Ton HPM 30" x 30", 250 Ton WS 28" x 24", 300 Ton WS 20" x 20", 300 Ton WS 24" x 29" Platen. 8-oz. WS, 9-oz. HPM, 4 oz. DeMattia Injection Molding Machines. Accumulators, Laboratory Presses, Platens & Oil Pumps, Pulverizers, Scrap Cutters, Grinders, Ball & Jewell, Cumberland. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. WOrth 4-8233.

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 16" x 48", and 15" x 36", 2 roll rubber mills. Farrel rebuilt 6" x 12" Lab. 2 Roll Mill. Other sizes up to 84". New 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. HPM 200 ton Hydr. Press, 4 opening, 32" x 36" platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 100 ton 24" x 24". Elms 75 ton 20" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250# W.P. W.S. 4 Pigr. High and low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins jacketed mixers 100, 50, 9, & 4½ gals. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO. 107-8th Street, Brooklyn, 15, N. Y., STerling 8-1944.

FOR SALE: One NRM Take-Off Conveyor. Latest style, with adjustable variable speed drive. Equipped with water spray assembly. Nearly new, used for only one week. Model 50, Serial No. 5588, 11 feet long, 6 inches wide. Complete price $1,800.00 F.O.B. Kansas City, Missouri. INJECTION MOLDING COMPANY, 75th & Cleveland Sts., Kansas City 30, Mo.

FOR SALE, two fifteen ton air operated Hanniffa compression presses model L-208. Excellent condition, sell for half of new cost. Reply, SOUTHEASTERN PLASTICS, INC., 106 Western Branch Blvd. Portsmouth, Va.

MORGAN & WRIGHT 8" vacuum extruder, complete with 50 h.p. motor, AC 3 phase, 60 cycle 440 V motor. JOHNSON MACHINERY CO., 653 Frelinghuysen Ave., Newark 5, N. J., Bigelow 8-2500.

1—1212 ROBINSON UNIQUE KNIFE CUTTER with Spiral Rotor and ½" perforated screen. Fitting with full set of knives 12" long (1 spare set of 8—12" inlaid high carbon steel knives). Flywheel fitted with 5 V grooves. Includes 1 sheave for motor for 1800 RPM, 4 grooves, motor shaft 1⅝"—K8—⅜"x3/16". 4 V belts for driving motor to cutter. 1 V belt for driving fan from cutter. Fitted with a pneumatic system. 1—10 HP 1400 RPM 220/440, 3 phase, 60 cycle ball bearing. Price: $1000.00. Reply Box 224, Modern Plastics.

SAVE WITH GUARANTEED REBUILT EQUIPMENT—RUBBER MIXING MILL, heavy duty 18"x48"; HYDRAULIC PRESSES: 28" x 24", 750 ton, 18" ram, HOBBING, 24"x18", 12" main ram, TRANSFER, 170 tons; 20"x20", 10" ram 110 tons, 24"x20", 10" ram, 110 tons; 20"x20", 10" ram, 200 tons, 30"x30", 8" ram, 75 tons, 15"x15", 8" ram, 75 tons, 19"x24", 10" ram, 75 tons, 12"x12", 6½" ram, 50 tons, 14"x14", 8" ram, 50 tons, 8"x9½", 4½" ram, 20 tons, 16"x16", 3½" ram, 12 tons; LABORATORY PRESSES: Carver, model 150, 10 ton, Buehler 16"x7" 12 ton; NEW UNIVERSAL DUAL PUMPING UNITS: 3 to 15 HP; NEW LABORATORY MILLS & CALENDERS; EXTRUDERS: Royle #1 Plastic, insulating type, NRM, 6", strainer type; ACCUMULATOR, HPM 6" ram, 2500#, PREFORM PRESSES all sizes, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO., INC., 255 Hudson St., New York 13, N.Y.

WE HANDLE HYDRAULIC PRESSES, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 336-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: Two model 1.5 Impco Hydraulic Molding Presses. Horizontal injection—vertical lock 50 tons, injection pressure 1000 P.S.I. plus compression cylinder of 10 tons. UNITED STATES TIME CORP., Box 2740, Little Rock, Arkansas—Attention: Engineering Department.

PARTIAL LIST OF AVAILABLE MACHINES may be inspected in operation. Leominster 8 oz. new 1945, $7000. Leominster 8 oz. new 1946, $7500. H.P.M. 7" 1942, $6500. 60 oz. Jackson & Church, new machine guarantee with capacity up to 100 oz. This is a very fast machine, $48,000. 12 oz. Lester, 1945, with extra cylinder, good condition, $10,000. 8 oz. DeMatti toggle type, $8500, 6 oz. Lester, $35.00. ACME MACHINERY & MANUFACTURING CO., 102 Grove St., Worcester, Mass.

One—24" reverse roll coater and pull roll winder, extremely accurate metering and coating device. Reply Ditto, Incorporated, Chicago, Illinois. Phone Nevada 2-1330. Contact Mr. L. L. Lovig.

MACHINERY and EQUIPMENT WANTED

WANTED: Plastics and Rubber Processing Machinery including Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set up plant now operating or shut down. When offering give full particulars. P.O. Box 1351, Church Street Sta., New York 8 N. Y.

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG CO., 102 Grove St., Worcester, Mass.

WANTED: 8 or 12 oz. Reed or Watson-Stillman late model—state price and where located. Box 232, Modern Plastics.

WANTED: 500 ton molding press, with or without pump. Must be in good operating condition; information in detail, including price, dimensions, etc. DICKTEN & MASCH MFG. CO., 900 E. Vienna Ave., Milwaukee 12, Wis.

PLANTS WANTED

Manufacturer needing additional molding capacity. Would be interested in purchasing all or part of an injection molding company in the middle west. Reply Box 204, Modern Plastics.

(*Continued on page 240*)

WE BUY "WHITE ELEPHANTS"!

$1,000,000.00
CASH AVAILABLE

for purchase of large quantities discontinued and surplus factory stocks:

PLASTIC PRODUCTS

Convert inventory headaches into CASH . . . clear your warehouses for new production! We'll take any quantity. Send sample; state lowest quotation, quantity and packing for quick deal. Dependable, prompt payment.

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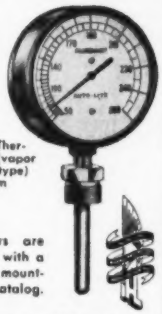
Model G Thermometer (one-to-one ratio, liquid filled type) Priced from $18.



Model V Thermometer (vapor pressure type) Priced from $10.25.

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MICCROSOL, a product of Michigan Chrome & Chemical Company, is a true vinyl plastisol which can be readily adapted, through special formulation, to meet the strictest requirements for: dipping, casting, slush molding, etc.

We will be pleased to submit a sample of one of our many proven coatings, or engineer a vinyl plastisol for your product.

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MICCRO Products

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Detroit 13, Michigan

CLASSIFIED ADVERTISING

(Continued from page 238)

PLANTS FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 213, Modern Plastics

MATERIALS FOR SALE

ATTENTION MAT USERS! FOR SALE: 2-oz. Fiberglas Mat in 175' New Rolls 1½-oz. Fiberglas Mat in 200' New Rolls in widths from 9" to 29" with #16 Finish. One edge Factory finish, other edge clean cut. Price 45c per pound F.O.B. Miami. Reply 233, Modern Plastics.

FOR SALE: Approximately 35,000 pounds of cast acrylic scrap plastic. Material located in the Los Angeles area. Will ship anywhere, or export. Make offer. Reply, JACK GLASS, P.O. Box 270, Monrovia, California.

FOR SALE: 3000 pounds Flesh and Pink Butyrate Molding Powder, reground 25 cents per pound. Reply Box 200, Modern Plastics.

PLASKON MELAMINE—3,000 lbs. in slightly damaged drums. Coral, blue, green. One third off list, delivered. Send for sample. Box 201, Modern Plastics.

FOR SALE: 10,800 lbs. virgin 475 Styron standard brown, 7,800 lbs. virgin 475 Styron standard maroon. Reply Box 234, Modern Plastics.

SCRAP P.V.C. and other thermoplastics in all forms. MICHAEL S. STEVENS, MERCHANTS Keswick Works, Keswick Road, London, S.W. 15, England.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Materials needed by INJECTION MOLDER (PRINCIPAL). Can use any quantity, any colors, Acetate or Butyrate, virgin or scrap. Reply Box 205, Modern Plastics.
ing. Reply Box 220, Modern Plastics.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 219, Modern Plastics.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 1671 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: Plastic scrap such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. CLAUDE P. BAMBERGER, INC., 152 Centre St., Brooklyn 31, N. Y., Tel. Main 5-5553. Not connected with with any other firm of similar name.

MOLDS FOR SALE

AVAILABLE AT ONCE
MOLDS FOR REALLY HOT AUTOMOTIVE ACCESSORIES
Two Airstream (Bug) Deflector Molds complete and in first class condition in every respect. Both two cavity, optical finish, on standard Detroit Mold Bases. HPM or Watson-Stillman 8 oz. machine for one, 12 oz. machine for other have been used. Reply Box 235 Modern Plastics

MOLDS AND MOLD BASE FOR SALE: 16 Cavity and core castings with universal mold base for injection molding for the manufacture of commercial forms used by the chocolate and ice cream manufacturers. NIAGARA PLASTIC MOLDS, INC., 3648 Genesee Street, Buffalo 25, New York.

MOLDS WANTED

BRUSH MOLDS AND BRUSH MACHINERY —Injection molds for ladies', men's, military, nail, tooth brushes, etc. Send particulars and samples. Reply Box 759, Realservice, 110 W. 34 St., New York, N. Y.

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

HELP WANTED

CHEMICAL ENGINEER wanted by Midwestern manufacturer. Master's degree, must have not less than two years research experience in addition to experience with resins and organic finishes. Supervisory and administrative experience desirable. Age 25 to 35 preferred. Reply stating background, qualifications and salary expected. Reply Box 214, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Have excellent assembly facilities which include all types of finishing, painting and decorative work. Reply Box 216, Modern Plastics.

DEVELOPMENT ENGINEER for plastic toys. Must be experienced in mechanics, die layout and injection molding techniques. Plant located in Los Angeles. Salary commensurate with experience and ability. Reply Box 206, Modern Plastics.

FIBERGLASS REINFORCED PLASTIC MOLDER wants representative for New England territory. Also for St. Lewis area. THE REPLAC CORP., 21830 St. Clair Ave., Cleveland, 17, Ohio.

LIKE PROBLEMS? CHEMICAL ENGINEER FOR DEVELOPMENT Leading medium size Chemical Company desires Chemical Engineer with interest in development work in plastics field. Must have some mechanical engineering experience or aptitude. Location near Buffalo. Include resume with your letter. Reply Box 228, Modern Plastics.

OUR FIRM IS ENTERING THE PLASTICS FIELD. We are interested in the services of a man, with or without formal education, who is experienced in all types of plastics to manage this new division. Apply to ROBOTYPER CORPORATION, 125 East Allen Street, Hendersonville, N. C.

PLANT SUPERINTENDENT: We have an opening for an experienced injection molding superintendent to administer the second shift in our large modern plant. Applicants must have proven supervision records. The individual selected will have a permanent position in suburban Chicago, a substantial salary, bonus and oppertunities for further advancement. FEDERAL TOOL CORPORATION, 3600 Pratt Blvd. Chicago, Illinois.

PLASTICS DESIGNER AND IDEA MAN Part Time or Fre Lance If you have bright ideas for saleable plastics products for office, household and school use, this is a real opportunity to make them "pay off." Knowledge of injection molding methods essential. Our company is medium size now and growing steadily. The right man will grow with it. Salary commensurate with your ability. Send salary requirements and resume to Box 230, Modern Plastics.

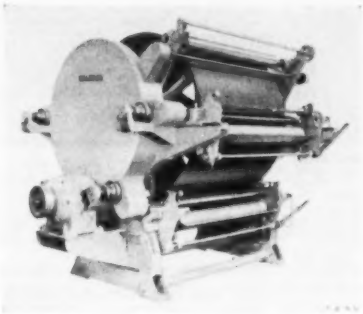
PLASTIC DEVELOPMENT ENGINEER: Experienced in vinyl extrusion and plastisol techniques. Require man with both mechanical and plastics background to handle product development assignment for large West Coast manufacturer. Write stating your complete background, qualifications and salary expected. Reply Box 210, Modern Plastics.

PLASTICS ENGINEER. Old line company, with established distribution, to open new Plastics Department and want experienced man to take complete charge of manufacturing. Must be familiar with compression molding. Melamine, etc. Products to be made are Trays, Dinnerware, Salad Bowls, Ice Buckets, Pitchers, etc. Our man must know best material for each item, machinery required, how to figure cost on finished products and other matters pertinent to manufacture of the above items. Plant is located in the middlewest section. Please state experience, salary expected, age, and educational background in your letter. We feel this is a wonderful opportunity for some one not afraid of responsibility and willing to grow with our company and the industry. Reply Box 229, Modern Plastics.

POLYESTER RESIN—TECHNICAL SALESMAN
WANTED by eastern resin manufacturer a man with wide sales development and application experience in Polyester Resins for the molding, casting, and laminating fields. Customer contact and plant application experience important. Headquarters Metropolitan New York. Salary dependent upon experience. All details should be included in first letter. Our employees know of this ad. Address replies to
Box 231, Modern Plastics

(Continued on page 242)

NEW!.. machine . . . Specially designed for



PRINTING Plastic Film & Sheeting

Other recent WALDRON machine developments include our low cost all-purpose ECCO roll coating unit and our all-purpose film and sheeting embossing assembly. Write for complete information.

Another WALDRON "First"! 4-color gravure print machine specifically built to handle plastic film and sheeting more efficiently, more accurately. This new WALDRON film printer embodies many new design features and operating advantages, including provision for conversion to surface printing operations. Write for full particulars.

JOHN WALDRON CORPORATION

LEADERS IN WEB PROCESS ENGINEERING SINCE 1827

NEW BRUNSWICK (P.O. BOX 791) NEW JERSEY

To our 'large casting' molders

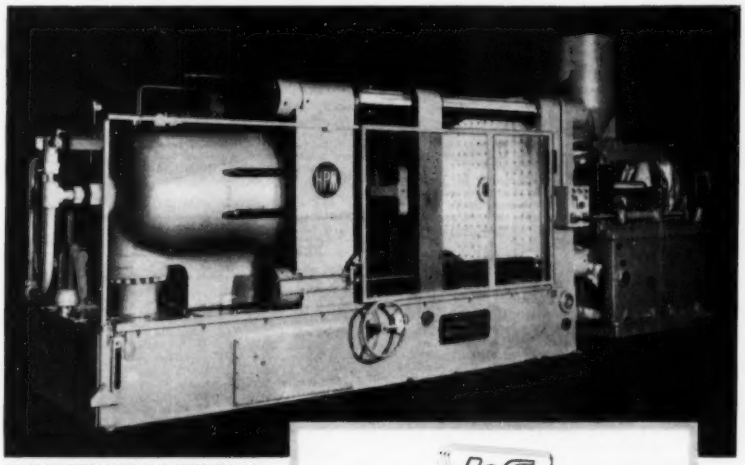


PHOTO COURTESY HYDRAULIC PRESS MFG. CO. MOUNT GILEAD, OHIO

Yes, you have the largest capacity presses built BUT—have you a tooling source that can fabricate molds that tax the full capacity of your presses? Our tooling facilities have been developed to keep abreast of your demands for large molds. We will be pleased to share our experience with you on your next large mold.

This giant plastics injection molding machine shown above is typical of the large machines for which we are equipped to make molds.

RSCO

RICHARD O. SCHULZ CO.

ELMWOOD PARK, ILLINOIS

DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION MOLDS

CLASSIFIED ADVERTISING

(*Continued from page 240*)

RESEARCH DIRECTOR AND RESEARCH CHEMIST needed for rapidly growing southern California vinyl plastic company with national distribution. Should be experienced in plastisol and hot melt fields. Give full particulars in letter—age, experience, education, references, personal history, salaries received, salary expected, and comments on willingness to move to California. Reply, Box 2392 Terminal Annex, Los Angeles 54, California.

PLASTISOL CHEMIST—Experienced in formulation and use of plastisols for dipping, casting, slush molding. Prefer man familiar with manufacture and servicing of plastisols for toy field. Unusual opportunity to organize department in fast growing N.Y. concern. Salary and bonus. Reply Box 227, Modern Plastics.

SALES ENGINEER. Outstanding opportunity in capital equipment sales—heavy industrial process measuring and control equipment—for a graduate engineer with five plus years of successful capital equipment sales experience and a thorough knowledge of sheet process manufacturing equipment in the paper, rubber, or plastics industry. Our organization is the recognized leader in the development and manufacture of industrial uses of nuclear energy and our continuous expansion offers unparalleled opportunity for a sales engineer capable of working with the executive echelon. Duties include the direction of supporting applications engineers. Qualified applicants are requested to submit a complete resume of education and experience to INDUSTRIAL NUCLEONICS CORPORATION, 1205 Chesapeake Avenue Columbus 12, Ohio.

SALESMEN for fast growing midwest injection molder. Will consider man controlling one account or deal. Prefer man with experience in plastics and capable of giving some engineering service to customer. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Men required in all industrial areas. Reply Box 217, Modern Plastics.

SALESMEN wanted by manufacturer for new attractive line of artificial leather and coated fabrics. Either salary or commission. State age, education, experience and basis of compensation. Several territories open. Outline territory of most interest to you. Address Box 208, Modern Plastics.

SALES MANAGER for well known line of phenolic molding compounds. Experience in selling molding compounds and management of sales department. Excellent opportunity for an aggressive manager who knows this market. Write, giving age, education, experience, references and recent photo. Reply Box 207, Modern Plastics.

WANTED—ENGINEER capable of estimating and designing compression and injection molds. Give full details of experience and education. Good position with rapidly growing concern outside Philadelphia. Reply Box 225, Modern Plastics.

WELL ESTABLISHED Colombia, S.A. firm seeks TECHNICIAN'S services in manufacturing, assembling, packaging items produced by injection molding such as combs, toys, household items, etc. Applicant should be under 40 years, with some knowledge Spanish language. Must have had at least 10 years' experience in the field and furnish good references. State salary applicant wishes to earn and marital status. REPLY BOX 226, MODERN PLASTICS.

SITUATIONS WANTED

PLANT MANAGER — Industrial Engineer: Age 35 with two years experience as Plant Manager, eight years as Industrial Engineer with large midwest paper and plastic company. Experience covers paper and plastic film assembly operations including heat sealing, sewing and packaging plus printing, embossing, coating, sheet cutting and rewinding. Desire management position with emphasis on responsibility, know-how and future. Reply Box 211, Modern Plastics.

PLASTICS ENGINEERING OR MANAGEMENT: Energetic, personable engineer with ability to produce results. Eleven years of diversified industrial experience: development, design, production and sales. Extensive knowledge of polyester laminates, sandwich laminates, extrusion and injection molding, coated fabrics, polymerization, etc. Chemical Engineer (BSE), Mechanical Engineer (MS), age 34. Los Angeles resident. Write Box 218, Modern Plastics.

Production FOREMAN with six years experience in compounding and all phases of Vinyl Plastics Calendering. Knowledge of "Z" and inverted "L" type Calenders producing light and heavy gauge film. Also embossing material. Have wide plant experience in productivity and efficiency. Interested any phase. Reply Box 209, Modern Plastics.

SALES AGENTS WANTED

MANUFACTURER AGENT, engineering type; —Individual or concern who is now covering industrial accounts, and desires to add to his coverage by adding representation in field of specialized fluorocarbons. Several sections are available. Your reply, stating territory covered, type of customers, and lines now handled, will be treated in confidence. Reply Box 221, Modern Plastics.

PLASTICS MOLD REPRESENTATIVE wanted for excellent quality machined or hobbed molds, and other precision tools. European built, at favorable prices, and good delivery time. Tool experience and large-concern contacts essential. Write Box 223, Modern Plastics.

SERVICES OFFERED

MANUFACTURERS AGENT contacts northern New Jersey industrial plants. Practical and technical experience. Est. 1945—office facilities. Desire additional line formed plastics on exclusive territory commission basis. JAMES L. FITZSIMMONS, 39 Lackawanna Plaza, Bloomfield, New Jersey.

POLYMEROID ENGINEERING CONSULTANTS. Here is the opportunity for the smaller manufacturer to have the benefits of a technical staff without the expense it entails. We are at liberty to advise on all phases of manufacture from raw material to finished product, including the machinery needed, cost of operation, plans, personnel required, etc. For information write Box 212, Modern Plastics.

WANTED—Sales organization desires Line of Plastic Articles to sell on commission basis. Address: C. J. EISENHOWER CO., Mt. Wolf, Pa.

WRITER—TECHNICAL LITERATURE. Experienced and versatile writer (published nationally) seeks freelance assignments in the N.Y.C. area. Technical, industrial and sales booklets, descriptive scientific brochures, general editing, catalogs, house organs, trade bulletins, newsletters, manuals, training literature, and reports. Box 215, Modern Plastics.

MISCELLANEOUS

ATTENTION MANUFACTURERS OF PLASTIC NOVELTY ITEMS—Available a new patented comb to be worn in the hair. First and Only comb ever patented to stay in the hair. Will sell outright or royalties. For further information write—Miss MADELYN WOOD, 115 Pleasant St., Leicester, Mass.

BIG BUSINESS OPPORTUNITY: Complete plastics manufacturing plant located in Los Angeles, California. Equipped to reclaim scrap plastic into sheeting. Machinery to manufacture electrical plastics tape and automotive plastic products. Associate must be able to invest $10,000.00 and take charge of sales and factory representatives. For further information write: JERSAR PLASTICS COMPANY, INC., 649 Gladys Avenue, Los Angeles, Calif.

IMPCO circulating oil heaters (2) in excellent condition. Also complete set toilet seat molds for use in "IMPCO" vertical injection molders. Contact E. Simon, UNIVERSAL TUBE & CONTAINER CO., 144 Moody St., Waltham 54, Mass.

MR. MOLDER, join the "Bradley Box Exchange." It costs you nothing and many molders have derived thousands of dollars of business through our organization. Your entry fee is merely a sample of each molded plastic box you have available. . . . We have thousands of clients seeking molded styrene boxes for packaging and sales promotion. We now represent over 50 molders. Write today and send samples to BRADLEY ASSOCIATES, INC. "world's largest source for molded plastic boxes"—1652 N. Damen Ave., Chicago, Illinois.

PLASTIC DISTRIBUTING business for sale, located in finest city central Calif., near San Francisco. Well-established, fast-growing, profitable wholesale bus. serving over 100 best dealers in Calif., Nev., Alaska. Specializing in finest, nationally advertised, unbreakable plasticwear. Will require about $17,000 investment. Ideal set-up for Eastern parties desiring to locate in Calif. Interested principles only write Box 236, Modern Plastics.

WANTED: Efficient molders in middle eastern states to subcontract large volume of injection molding and finishing. Reply Box 203, Modern Plastics.

WANTED—to make arrangements with reliable party for manufacture and distribution of new, novel toy that appeals to all children. Has mechanical action, eye appeal, is different. metal. Work on royalty or other basis. Here is Can be produced at popular price in plastics or real opportunity. For further details write E. D. SHERR'LL, 327 Sixth St., NW., Hickory, N.C.

All classified advertisements payable in advance of publication

Closing date: 1st of preceding month; e.g., February 2nd for March issue

Up to 60 words.....$10.00	Up to 120 words.....$20.00	Up to 180 words.....$30.00
Up to 60 words (boxed)..$20.00	Up to 120 words (boxed)..$40.00	Up to 180 words (boxed)..$60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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Because we've had many years experience in molding with this tough, shock and wear-resistant material. We have precision-molded countless thousands of fine gears, bushings, washers, skid blocks, rollers, rivets, etc., in our complete and most modern plant.

Sinko also molds all other thermoplastic materials with equal precision and care; and the many leading manufacturers we serve today attest to our ability to accurately produce the most intricate injection molded products, and metal-plastic assemblies.

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3135 W. GRAND AVENUE • CHICAGO 22, ILLINOIS

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"STANDARD"
EMBOSSING PLATES

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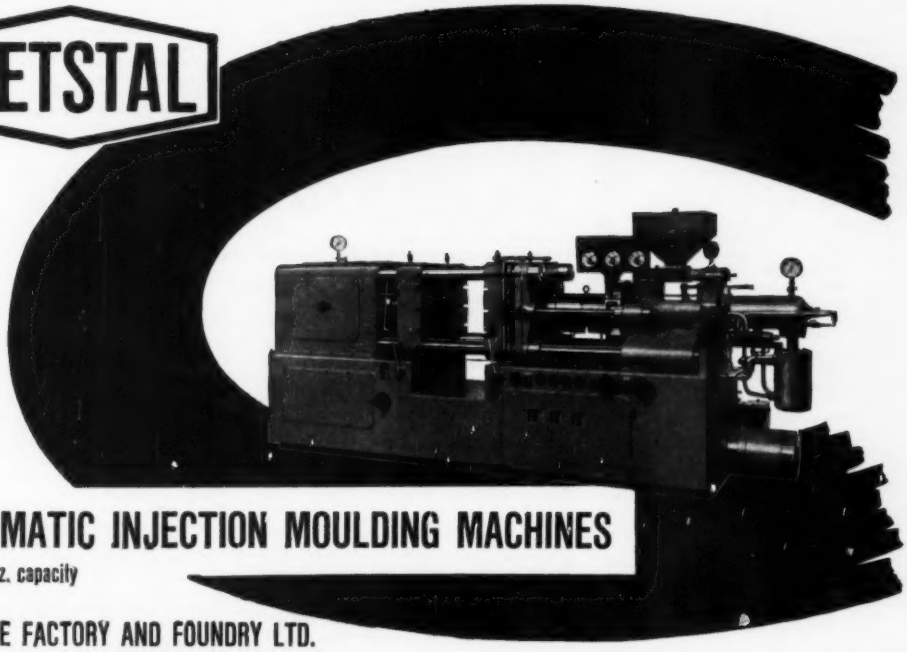

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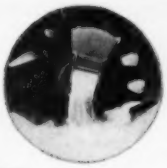

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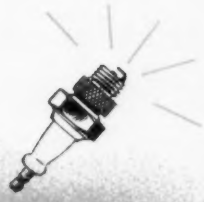

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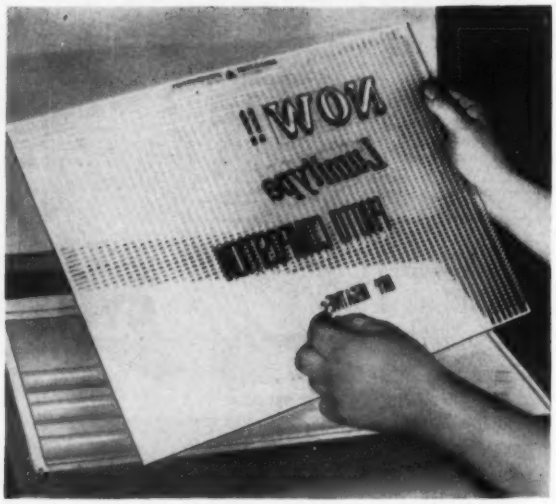

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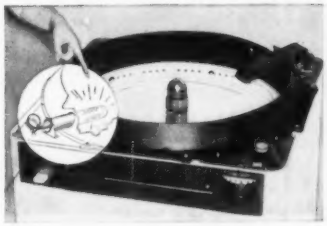

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